

PPR-2749

Test Report No. 755.BTND.093A.2010

**Tyco Electronics Raychem GmbH
Type Test of 24 kV Outdoor Terminations for
3-Core XLPE Cables**

Type EPKT-24C3XOH2-ID02

Tested by: Loporan Pengujian

Date: March 5, 2010 - July 12, 2010

Pages: 50

Appendix: —

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Energy Division

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**LAPORAN PENGUJIAN
TEST REPORT**

No : 755.BTND.093A.2010

TYPE TEST

CABLE ACCESSORIES

OUTDOOR TERMINATION

FOR THREE-CORE XLPE CABLES, 12/20 (24) kV

TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

CLIENT : TYCO ELECTRONICS RAYCHEM GmbH



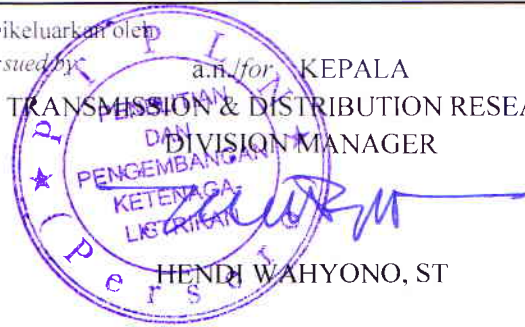


PT PLN (PERSERO)

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	PLN LITBANG	LAPORAN PENGUJIAN TEST REPORT	No. 755.BTND.093A.2010	 <small>Kualitas & Integritas Melayani</small> LABORATORIUM PENGUJIAN LP-005-IDN
			Tgl Date 13/07/2010	
Peminta Jasa Client		TYCO ELECTRONICS RAYCHEM GmbH FINSINGER FELD 1 85521 OTTOBRUNN/MUNCHEN		
Nomor KPJ/Order No. 093A/2009		Penulis Author Deputy Manager of Transmission & Distribution Research Laboratory		
Jumlah laporan Number of copies 2		Jumlah halaman Number of pages 50		
Keterangan Reff. Letter of reference : No. : - Date : 09/10/2008		Dikeluarkan oleh Issued by a.n./for KEPALA TRANSMISSION & DISTRIBUTION RESEARCH DIVISION MANAGER  HENDI WAHYONO, ST		
Judul Title		TYPE TEST CABLE ACCESSORIES OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01 CLIENT : TYCO ELECTRONICS RAYCHEM GmbH		
Ringkasan Summary		<p>The type test on Outdoor Termination for Three-core XLPE Cables, 12/20 (24 kV), trademark RAYCHEM, type EPKT-24C3XOH2-ID01, was carried out on 2 October up to 29 December 2009.</p> <p>Test reference : IEC 60502-4 (2005-02)</p> <p>The Outdoor termination mentioned above has conformed to the standard requirement.</p>		

LABTND 2010|093A-09-tycoelectronic-terminasi pasangan luar merek RAYCHEM

Keluhan atas isi dokumen hanya dilayani bila disampaikan paling lambat tiga bulan sejak diterbitkan. Dokumen ini berlaku lima tahun sejak diterbitkan, sepanjang standar/spesifikasi yang bersangkutan masih berlaku. Dokumen ini tidak boleh digandakan tanpa persetujuan tertulis dari PT PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan - Bidang Penelitian Sistem Transmisi dan Distribusi, kecuali secara lengkap.

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TEST DESCRIPTION

1. SCOPE

In accordance with requested letter from TYCO ELECTRONICS RAYCHEM GmbH No. -, dated 09/10/2008 has been carried out the type test on cable accessories.

2. TECHNICAL DATA

Type of accessories	: Outdoor termination
No. of core	: Three-core
Type of cable insulation	: XLPE
Shaped of conductor	: Round stranded
Rated voltage (U ₀ /U (U _m))	: 12/20 (24) kV
Arus gangguan tanah	: 1 kA-1s
Trademark	: RAYCHEM
Type	: EPKT-24C3XOH2-ID01
Manufacturer	: Tyco Electronics Raychem GmbH

3. TEST REFERENCE

IEC 60502-4 (2005-2) Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m = 1,2 kV) up to 30 kV (U_m = 36 kV)

Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV).

4. TEST PERFORMANCE

Sample taken by	: TYCO ELECTRONICS RAYCHEM GmbH
Date of sample(s) received	: 02/10/2009
Quantity of sample(s)	: 4 sets, sample No 1.1, 1.3 and 1.5
Place of test	: Transmission & Distribution Research Laboratory
Date of test	: 2 October up to 29 December 2009
Tested by	: pas, pri

5. INSTALLATION OF THE ACCESSORIES

- Cable for test loops was NA2XSEYBY 3 x 240 mm², 12/20 (24) kV
- Installation of the accessories on the cable test loops was conducted by Mr. Patrick Lau
- Accessories was assembled in according to manufacturer's instruction.

6. TEST RESULTS

- | | |
|---|----------------------|
| 6.1 Identification of test cable and accessories component | : see page 6 up to 9 |
| 6.2 Test sequence for samples No 1.1 | |
| a) AC voltage test | : passed |
| b) Partial discharge at ambient temperature | : passed |
| c) Impulse test at θt | : passed |
| d) Heating cycles test in air (30 cycles) | : passed |
| e) Partial discharge test at θt and ambient temperature | : passed |
| f) Impulse test at ambient temperature | : passed |
| g) AC voltage test | : passed |

6.3 Test sequence for samples № 1.3

- a) AC voltage test : passed
- b) Thermal short-circuit test on screen : passed
- c) Thermal short-circuit test on conductor : passed
- d) Dynamic short-circuit test : passed
- e) Impulse test at ambient temperature : passed
- f) AC voltage test : passed

6.4 Test sequence for samples № 1.5

- a) Salt Fog Test : passed

The comprehensive test results are given in the appendixes.

7. CONCLUSION

The type test on Outdoor termination for Three-core XLPE cables, 12/20 (24) kV, trademark RAYCHEM, type EPKT-24C3XOH2-ID01 have passed successfully.

8. REMARKS

This technical report is not to certify for judging the quality of product lot and valid for the sample tested only.

To judge a product lot in the delivery procedure it will perform a sample test, in order to verify whether the product delivered have the same quality with this type of this sample.

TRANSMISSION AND DISTRIBUTION RESEARCH DIVISION

Transmission & Distribution Research Laboratory

Deputy Manager.



Satyagraha A Kadir, ST

APPENDIX I

IDENTIFICATION OF CABLE AND ACCESSORIES COMPONENT

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

IDENTIFICATION OF TEST CABLE AND ACCESSORIES COMPONENT

Identification of test cable

Type of cables	NA2XSEYBY	
Rated voltage (U _o /U (U _m))	12/20 (24) kV	
Standard	IEC 60502-2	
Trademark	SUPREME	
No. of core	<input type="checkbox"/> Single-core	<input checked="" type="checkbox"/> Three-core
		<input checked="" type="checkbox"/> Individually screen
Conductor(s)	<input checked="" type="checkbox"/> Aluminium	<input type="checkbox"/> Copper
	<input checked="" type="checkbox"/> Stranded	<input type="checkbox"/> Solid
	<input checked="" type="checkbox"/> Round	<input type="checkbox"/> Sector shaped
Cross-section area	<input type="checkbox"/> 120 mm ²	<input type="checkbox"/> 150 mm ²
		<input type="checkbox"/> 185 mm ²
	Other cross-section area	<input checked="" type="checkbox"/> 240 mm ²
Insulation	<input type="checkbox"/> PVC	<input checked="" type="checkbox"/> XLPE
	<input type="checkbox"/> EPR	<input type="checkbox"/> HEPR
Insulation screen	<input type="checkbox"/> Bonded	<input checked="" type="checkbox"/> Strippable
Metallic screen	<input checked="" type="checkbox"/> Wires	<input type="checkbox"/> Tapes
	<input type="checkbox"/> Extruded	
	Cross-section area	25,37 mm ²
Oversheath	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> PE (ST3)
	<input type="checkbox"/> PE (ST7)	
Water blocking	<input type="checkbox"/> In conductor	<input type="checkbox"/> Under oversheath
Diameter		
- Conductor	18,1 mm	
- Insulation	30,5 mm	
- Insulation screen	31,7 mm	
- Oversheath	89,1 mm	
Cable marking	SPLN 43 SUPREME CABLE NA2XSEYBY 3X240 CM 25 12/20 KV 24 KV LMK	

Identification of Cable lugs

Trademark	Tyco Electronics
Type	BLMT - 95/240-13 (torque) see page 9/50
Preparation of contact surfaces	-
Type test approval	-
Compression tool	-
Trademark	-
- Type	-
- Dies	-
- Shape of dies	-

Identification of cable accessories

Type of accessories	Outdoor termination
Name of manufacturer	RAYCHEM
Type	EPKT-24C3XOH2-ID01
Designation	Outdoor
Manufacturing date or code	
Range of cable cross-sections	95 - 240 mm ²
Material of cable conductor	-
Shape of cable conductor	-
Range of cable insulation diameters	-
Rated voltage (U _o /U (U _m))	12/20 (24) kV
Installation instructions	
- No. Reference	see page 43 up to 50
- Date	
List of component	see page 44/50

Tested by : <i>F-</i>	Checked by : <i>BE</i>
Date :	Date : <i>13/07/2010</i>

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

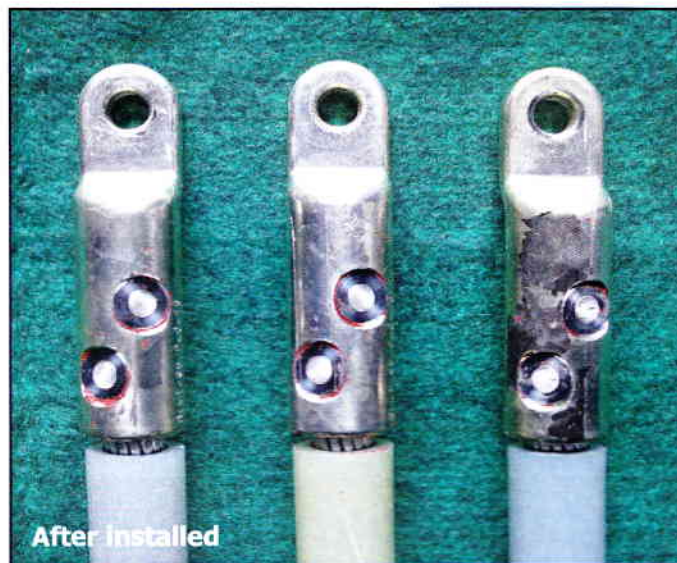
PHOTOGRAPH



ase

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

CABLE LUG



ase

APPENDIX II
TEST SEQUENCE FOR SAMPLES № 1.1

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) KV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

AC VOLTAGE TEST

Test voltage : 54 kV-AC
 Duration : 5 minutes

Sample No	Core	Test result	Leakage current [mA]
1.1	1	Withstood	40
	2	Withstood	40
	3	Withstood	40
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

AC VOLTAGE TEST (WET)

Test voltage : 48 kV-AC
 Duration : 1 minutes
 Water conductivity : 102 Ohm-m

Sample No	Core	Test result	Leakage current [mA]
1.1	1	Withstood	-
	2	Withstood	-
	3	Withstood	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

Tested by :

f-

Date : 02-10-2009 & 05-10-2010

Checked by :

lge

Date : 13/07/2010.

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

PARTIAL DISCHARGE TESTS

Sample №	Core	Partial discharge at 20 kV [pC]			
		at ambient temperature	Standard requirements	at θ_t	Standard requirements
1.1	1	0,8	≤ 10	-	-
	2	1,0		-	
	3	0,8		-	
	-	-		-	
	-	-	-	-	-
	-	-		-	
	-	-		-	
	-	-		-	

Note : θ_t is the maximum cable conductor temperature in normal operation +5 K to 10 K

Tested by : *f-*
 Date : 05-10-2009

Checked by : *[Signature]*
 Date : 13/07/2010 .

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

IMPULSE TEST

Impulse wave shape

Polarity	Wave shape			Oscillogram No.
	front time [μ s]	tail time [μ s]	over-shoot [%]	
Positive	4,86	53,40	0	IM09-093201, IM09-093202
Negative	4,65	53,80	0	IM09-093203, IM09-093204
Criteria	1 - 5	40 - 60	≤ 5	-

Test results

Conductor temperature : θ_t
 Test voltage : 125 kV 1,2/50 μ s
 No. of impulse : 10 impulse of each polarity

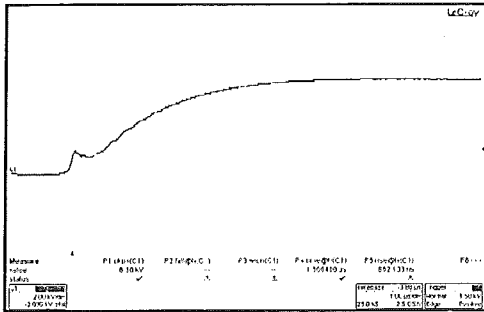
Sample No	Core	Polarity	Test result	Oscillogram No.
1.1	1	Positive	Withstood	IM09-093205 - IM09-093214
	2		Withstood	
	3		Withstood	
	-		-	
	1	Negative	Withstood	IM09-093215 - IM09-093224
	2		Withstood	
	3		Withstood	
	-		-	

Note : θ_t is the maximum cable conductor temperature in normal operation +5 K to 10 K

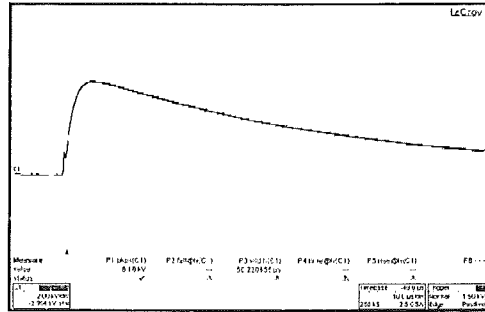
Tested by : *Y-*
 Date : 26-10-2009

Checked by : *Be.*
 Date : 13/07/2010.

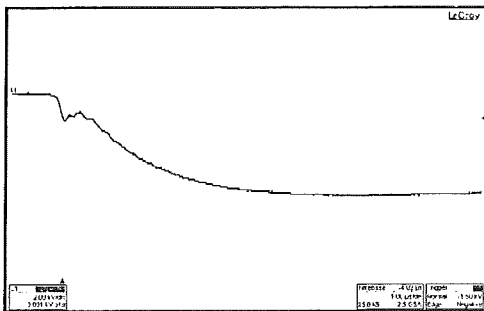
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POSITIVE WAVE - FRONT



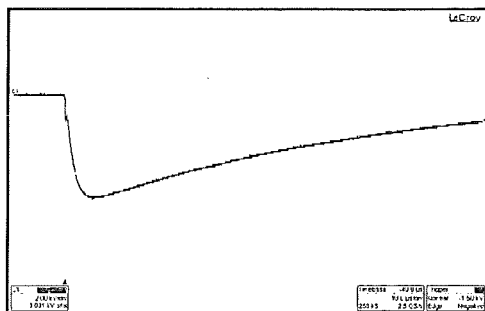
IM09-093202
POSITIVE WAVE - TAIL



IM09-093203
NEGATIVE WAVE - FRONT

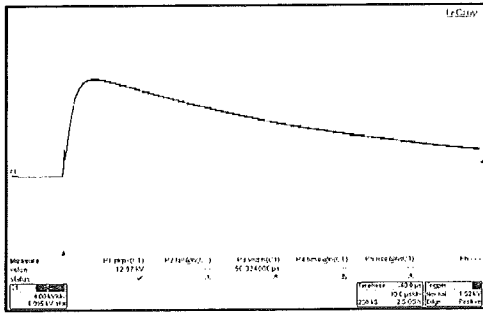


IM09-093204
NEGATIVE WAVE - TAIL

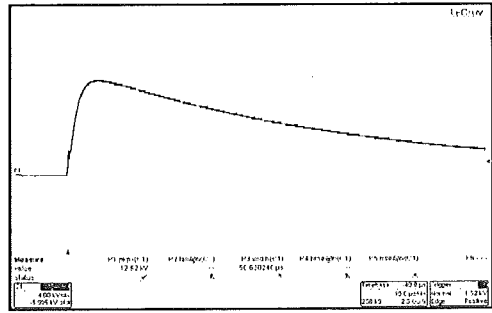


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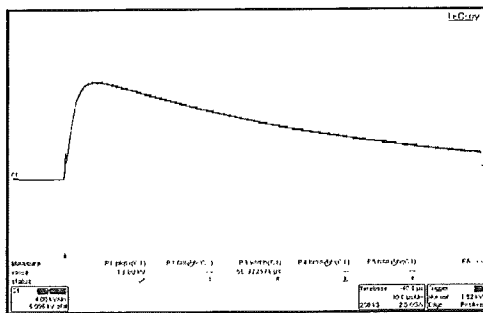
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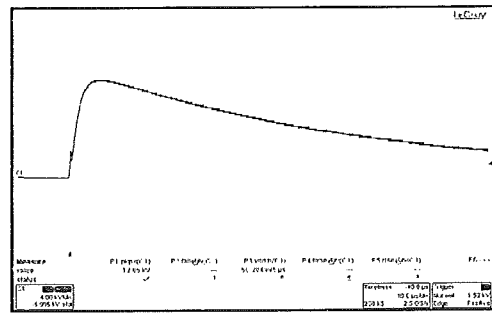
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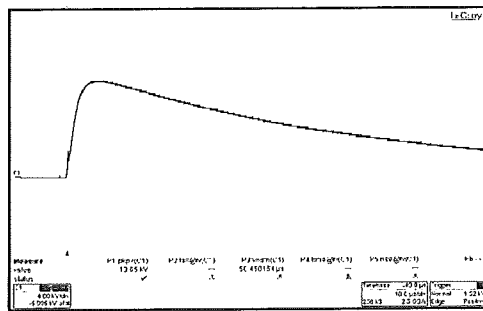
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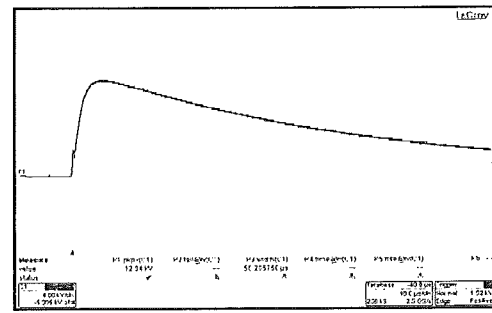
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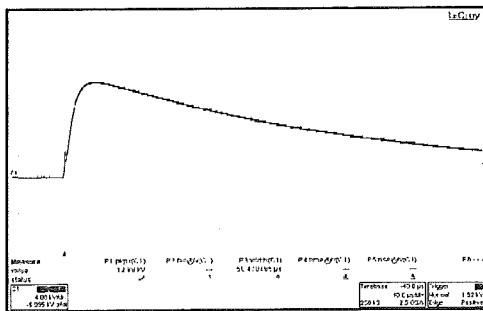
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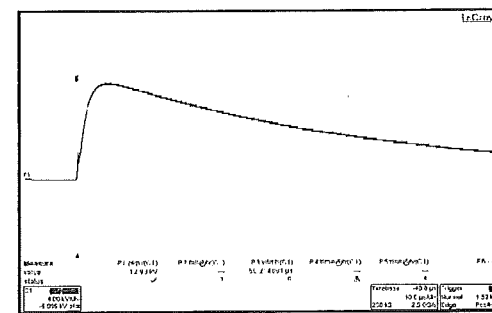
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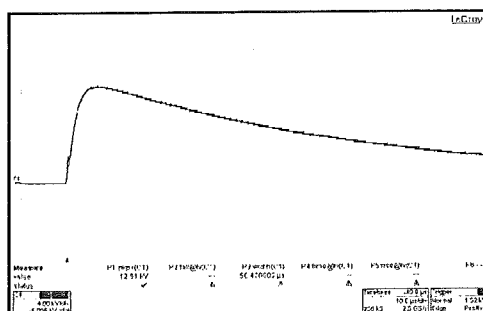
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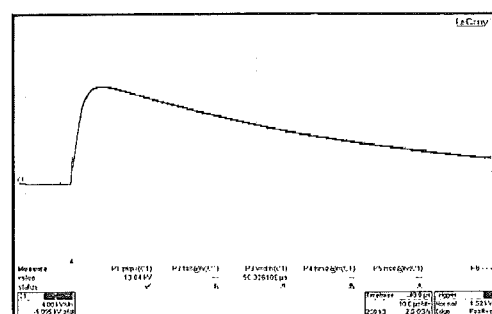
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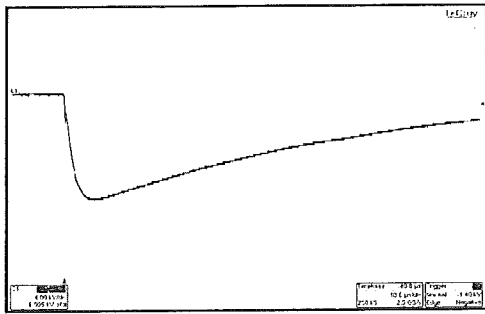


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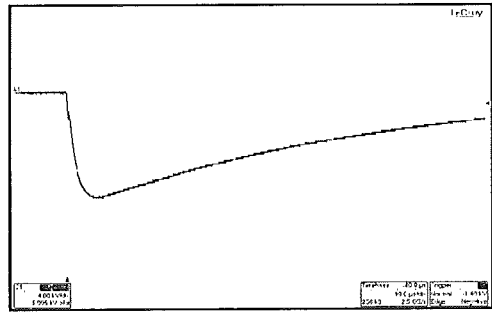


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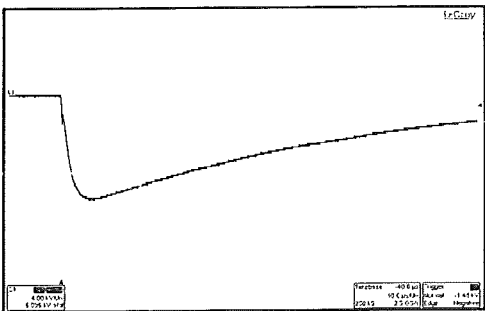
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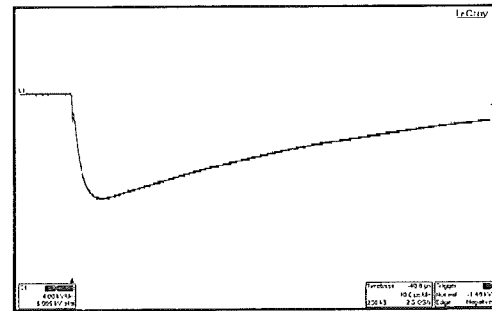
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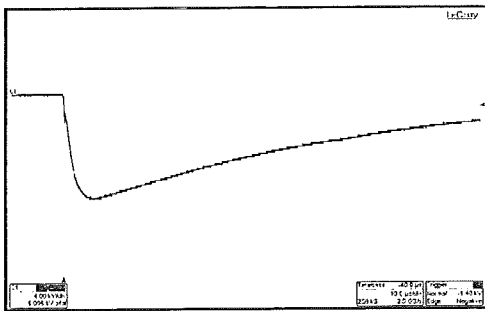
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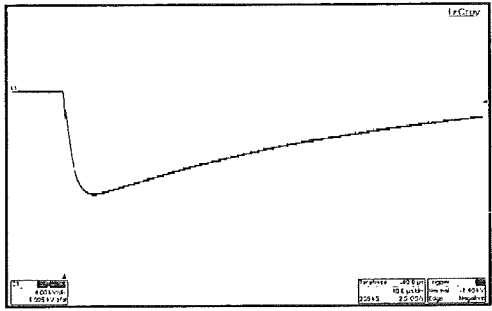
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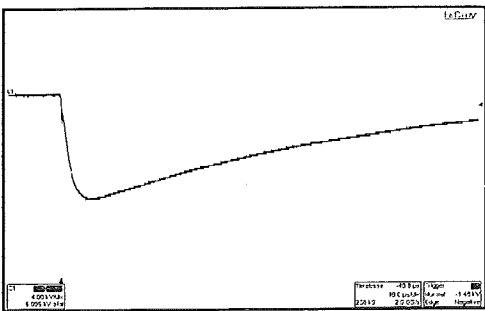
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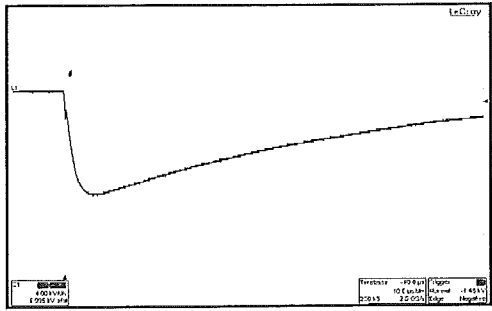
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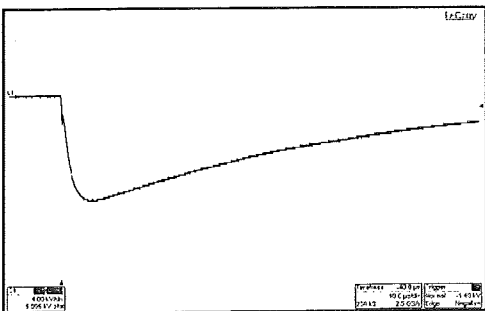
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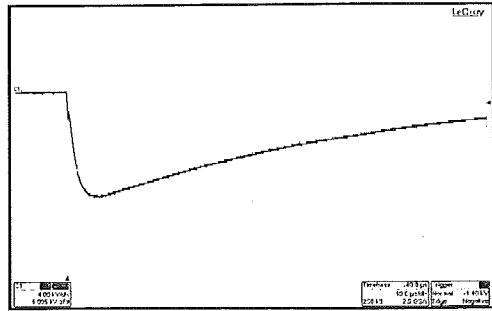
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IM09-093223



IM09-093224

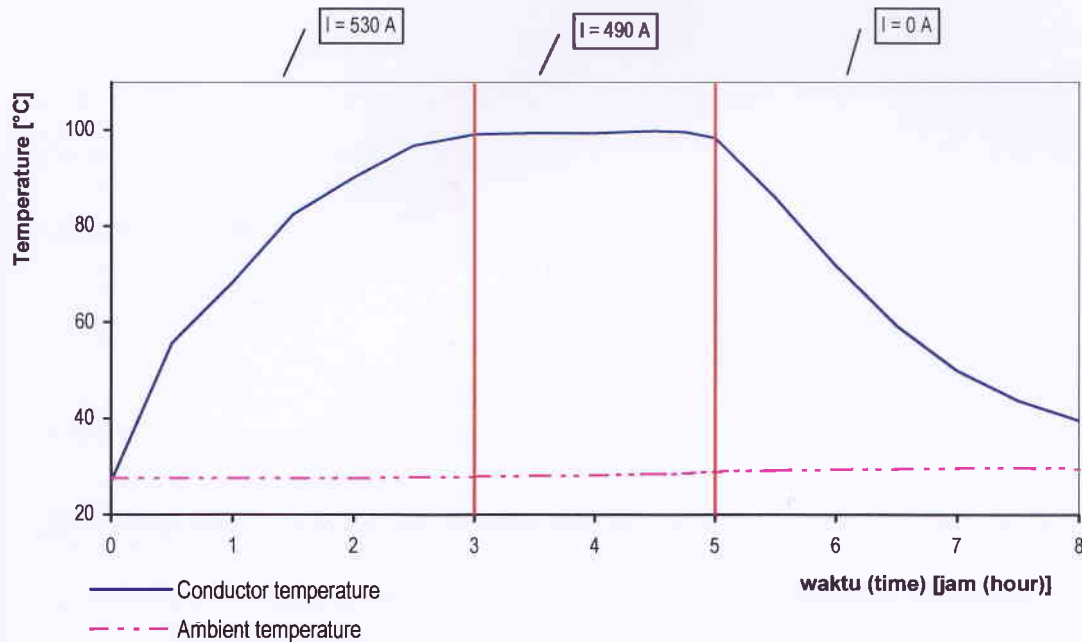


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OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

HEATING CYCLES TEST

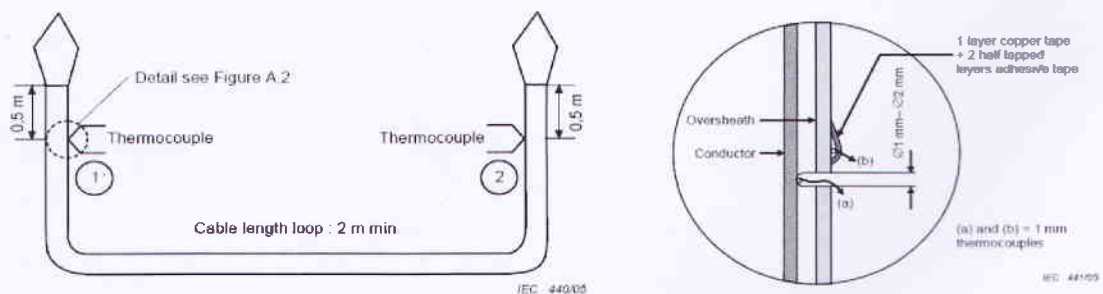
Test current and θt



θt is the maximum cable conductor temperature in normal operation +5 K to 10 K

Type of cable insulation	XLPE
Maximum cable conductor temperature [°C]	90
Test temperature of conductor (θt) [°C]	99,9
Criteria of test temperature [°C]	95 ~ 100
Ambient temperature [°C]	29
Test current [A]	I_1 530
	I_2 490

Arrangement of the thermocouples



Tested by : *[Signature]*

Date : 28-10-2009 - 17-11-2009

Checked by : *[Signature]*

Date : 13/07/2010.

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

HEATING CYCLES TEST IN AIR

No. of cycles : 60
 Test voltage : 30 kV-AC

Sample №	Core	Test condition	Test result
1.1	1	Each heating cycle in air shall be of at least 8 h duration with at least 2 h at a steady temperature of θ_t , followed by at least 3 h of natural cooling to within 10 K of ambient temperature	Good
	2		Good
	3		Good
	-		-

HEATING CYCLES TEST UNDER WATER

No. of cycles : -
 Test voltage : -
 Height of water : -

Sample №	Core	Test condition	Test result
-	-	N/A	-
	-		-
	-		-
	-		-

Tested by : *f-*
 Date : 28-10-2009 - 17-11-2009

Checked by : *lge*
 Date : 13/07/2010 -

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

PARTIAL DISCHARGE TESTS

Sample №	Core	Partial discharge at 20 kV [pC]			
		at ambient temperature	Standard requirements	at θ_t	Standard requirements
1.1	1	1,0	≤ 10	0,1	≤ 10
	2	2,0		0,1	
	3	1,0		0,1	
	-	-		-	
-	-	-	-	-	-
	-	-		-	
	-	-		-	
	-	-		-	

Note : θ_t is the maximum cable conductor temperature in normal operation +5 K to 10 K

Tested by : *f.*

Date : 20-11-2009

Checked by : *lge.*

Date : 13/07/2010 -

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

IMPULSE TEST

Impulse wave shape

Polarity	Wave shape			Oscillogram No.
	front time [μs]	tail time [μs]	over-shoot [%]	
Positive	3,38	53,25	0	IM09-093231, IM09-093232
Negative	3,70	53,05	0	IM09-093233, IM09-093234
Criteria	1 - 5	40 - 60	≤ 5	-

Test results

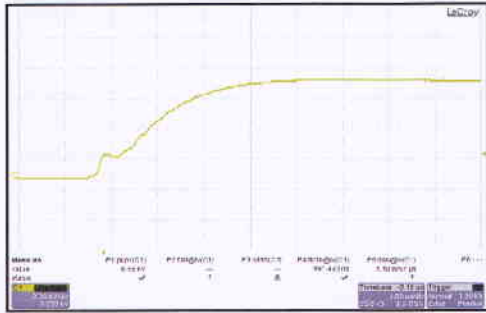
Conductor temperature : 30 °C
 Test voltage : 125 kV 1,2/50 μs
 No. of impulse : 10 impulse of each polarity

Sample №	Core	Polarity	Test result	Oscillogram No.
1.1	1	Positive	Withstood	IM09-0932035 - IM09-0932044
	2		Withstood	
	3		Withstood	
	-		-	
	1	Negative	Withstood	IM09-0932045 - IM09-0932054
	2		Withstood	
	3		Withstood	
	-		-	

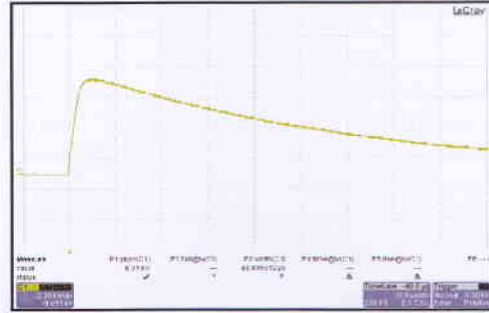
Tested by : *f.*
 Date : 26-11-2009

Checked by : *ase.*
 Date : 13/07/2010 -

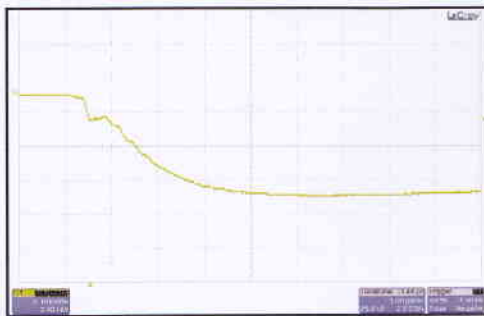
IM09-093231 ~
POSITIVE WAVE - FRONT



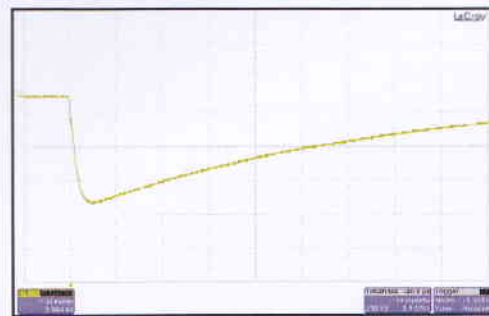
IM09-093232
POSITIVE WAVE - TAIL



IM09-093233
NEGATIVE WAVE - FRONT

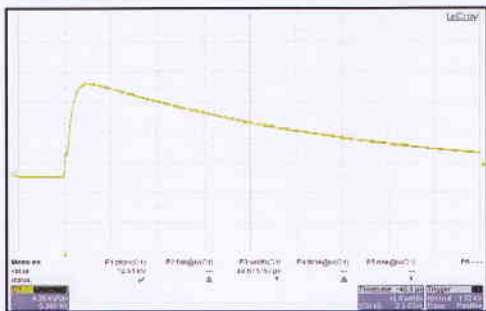


IM09-093234
NEGATIVE WAVE - TAIL

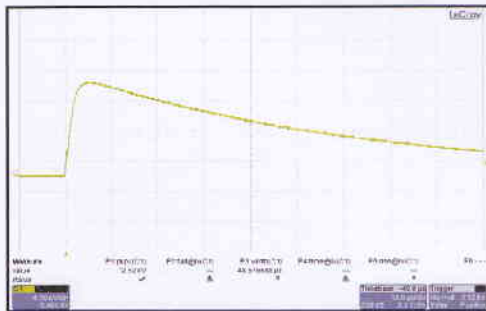


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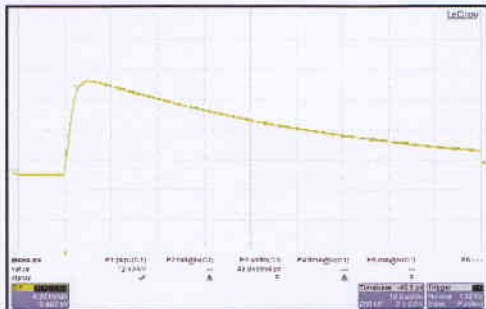
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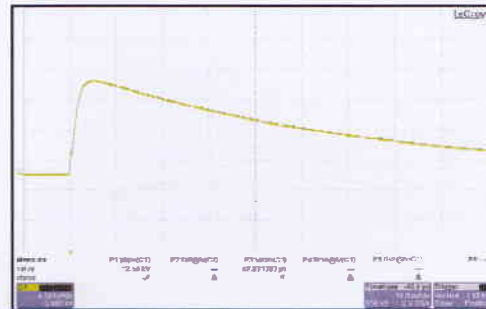
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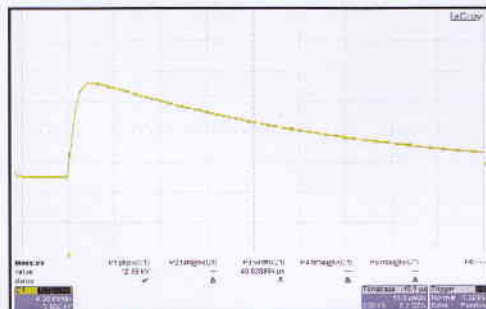
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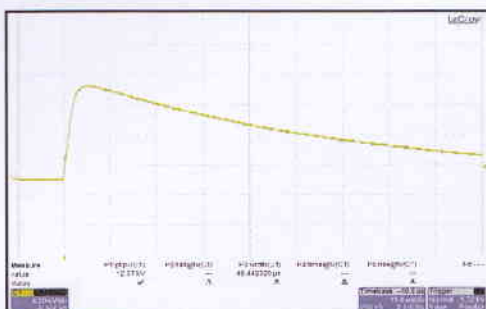
IM09-0932038



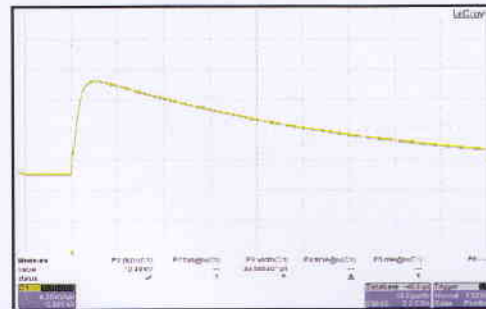
IM09-0932039



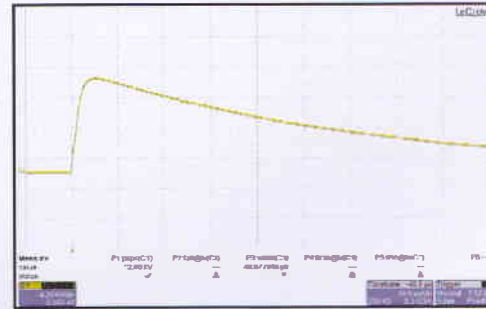
IM09-0932040



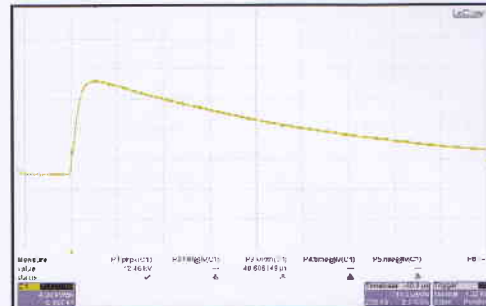
IM09-0932041



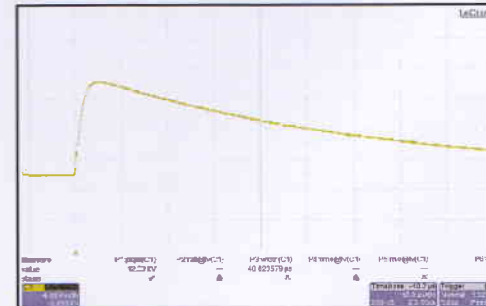
IM09-0932042



IM09-0932043

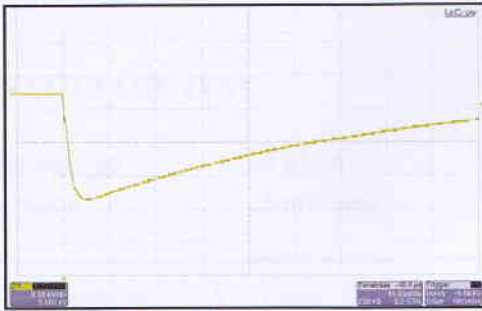


IM09-0932044

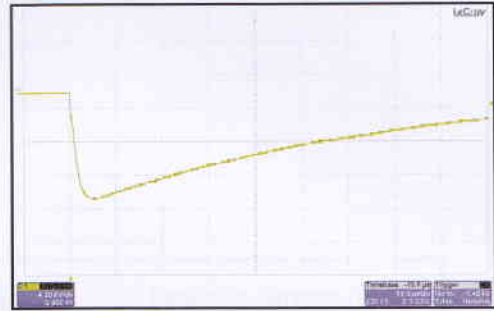


lose

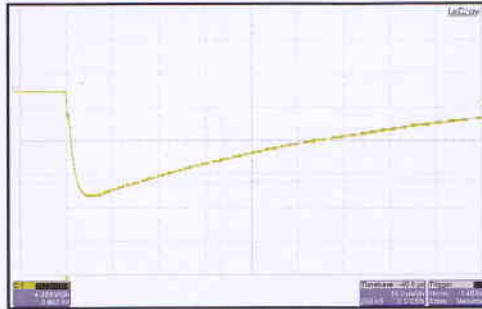
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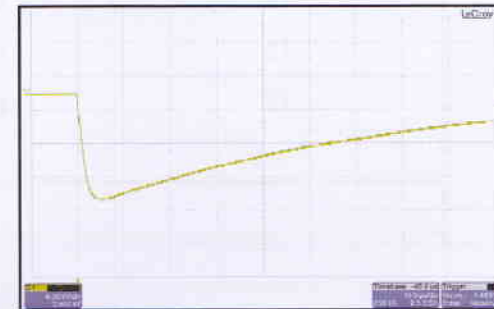
IM09-0932046



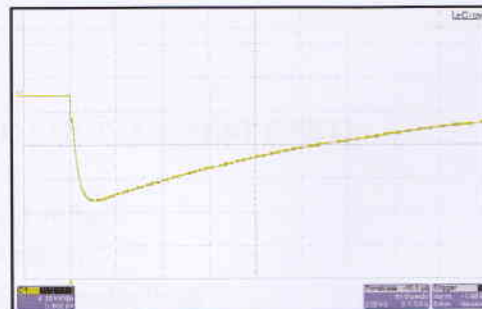
IM09-0932047



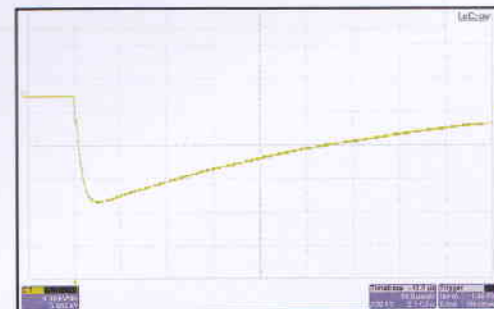
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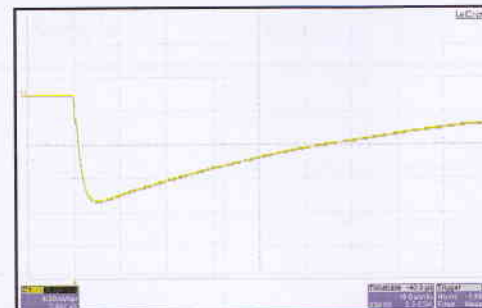
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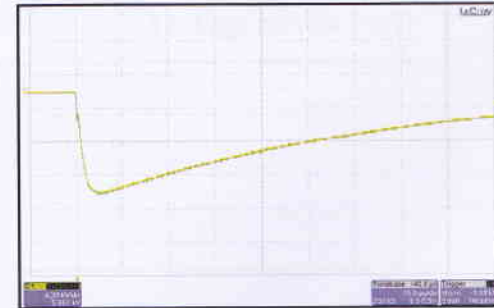
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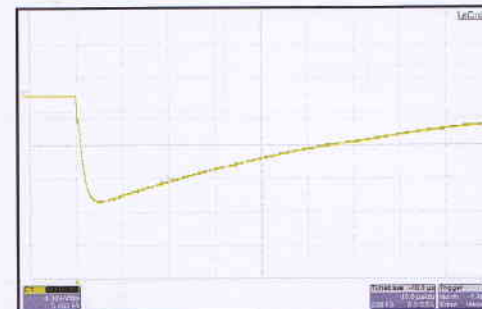
IM09-0932051



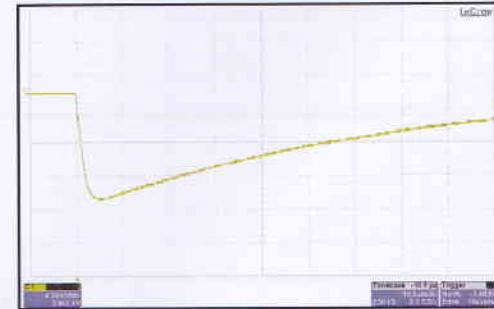
IM09-0932052



IM09-0932053



IM09-0932054



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OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

AC VOLTAGE TEST

Test voltage : 30 kV-AC
 Duration : 15 minutes

Sample No	Core	Test result	Leakage current [mA]
1.1	1	Withstood	21
	2	Withstood	21
	3	Withstood	21
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

AC VOLTAGE TEST (WET)

Test voltage : -
 Duration : -
 Water conductivity : -

Sample No	Core	Test result	Leakage current [mA]
-	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

Tested by : *f.*
 Date : 26-11-2009

Checked by : *Be.*
 Date : 13/07/2010 -

APPENDIX III
TEST SEQUENCE FOR SAMPLES № 1.3

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

AC VOLTAGE TEST

Test voltage : 54 kV-AC
 Duration : 5 minutes

Sample №	Core	Test result	Leakage current [mA]
1.3	1	Withstood	40
	2	Withstood	40
	3	Withstood	40
	-	-	-
-	-	-	-
	-	-	-
	-	-	-
	-	-	-

AC VOLTAGE TEST (WET)

Test voltage : -
 Duration : -
 Water conductivity : -

Sample №	Core	Test result	Leakage current [mA]
-	-	-	-
	-	-	-
	-	-	-
	-	-	-
-	-	-	-
	-	-	-
	-	-	-
	-	-	-

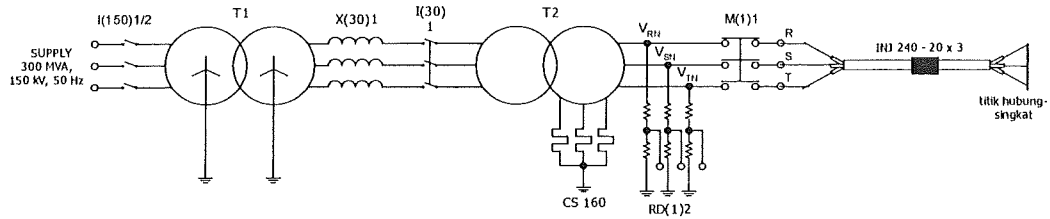
Tested by : *[Signature]*
 Date : 02-10-2009

Checked by : *[Signature]*
 Date : 13/07/2010 .

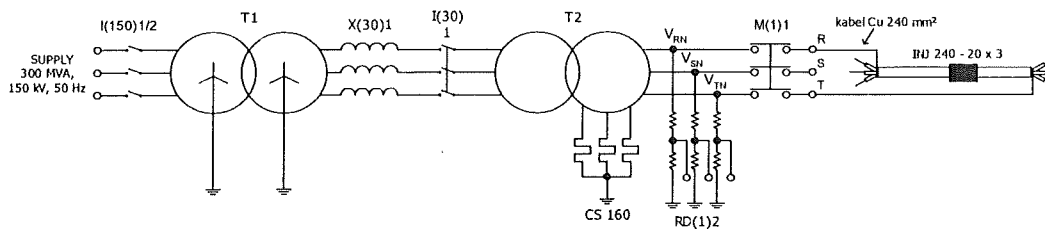
SHORT-CIRCUIT TESTS

Test circuits

Test on conductors



Test on metallic screen



Remarks

- I(150)1/2 : Circuit breaker 150 kV
- T1 : Transformer 3 x 100 MVA, 1s
- X(30)1 : Reactor 30 kV
- I(30)1 : Circuit breaker 30 kV (making switch)
- R (30) 1 : Resistor 30 kV
- T2 : Transformer 189 MVA, 1s
- CS 160 : Shunt 160 kA
- RD (1)2 : Resistor Divider

Calculation of test current

Material of cable insulation		XLPE
Maximum cable conductor temperature (θ_{sc})	°C	250
Short-circuit duration (t)	s	5
Material of cable conductor		Aluminium
Conductor cross-sectional area	mm ²	240
Conductor temperature at start of test (θ_i)	°C	30
$I^2t = 2,19 \times 10.000 \times S^2 \times \ln \frac{\theta_{sc} + 228}{\theta_i + 228}$		(kA) ² .s 778
Short-circuit rms current for 1s (I)	kA	27,9
Short-circuit dynamic current (I _p)	kA	69,7

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

THERMAL SHORT-CIRCUIT TESTS ON CONDUCTOR

Test No.	Test voltage [V]		Test current [kA]		Duration [s]	I ² t [(kA) ² .s]	Condition after the test current applied	Oscillogram No.
	V _{RN}	V _{SN}	I _R	I _S				
1	V _{RN}	257	I _R	16,72	3,02	834,8	good	09093201
	V _{SN}	259	I _S	16,83				
	V _{TN}	258	I _T	16,37				
2	V _{RN}	246	I _R	16,40	3,01	812,7	good	09093202
	V _{SN}	248	I _S	16,76				
	V _{TN}	246	I _T	16,12				
Standard requirement			-	-	778	No visible damage	-	

DYNAMIC SHORT-CIRCUIT TEST ON CONDUCTOR

Test No.	Test voltage [V]		Test current [kA]			Duration [s]	Condition after the test current applied	Oscillogram No.
			peak current	symmetrical current				
1	V _{RN}	249	I _R	-	32,00	0,090	good	09093203
	V _{SN}	251	I _S	-	33,23			
	V _{TN}	252	I _T	70,10	33,38			
Standard requirement			69,7	-	-	No visible damage	-	

THERMAL SHORT-CIRCUIT TESTS ON METALLIC SCREEN

Conductor temperature : θ_t

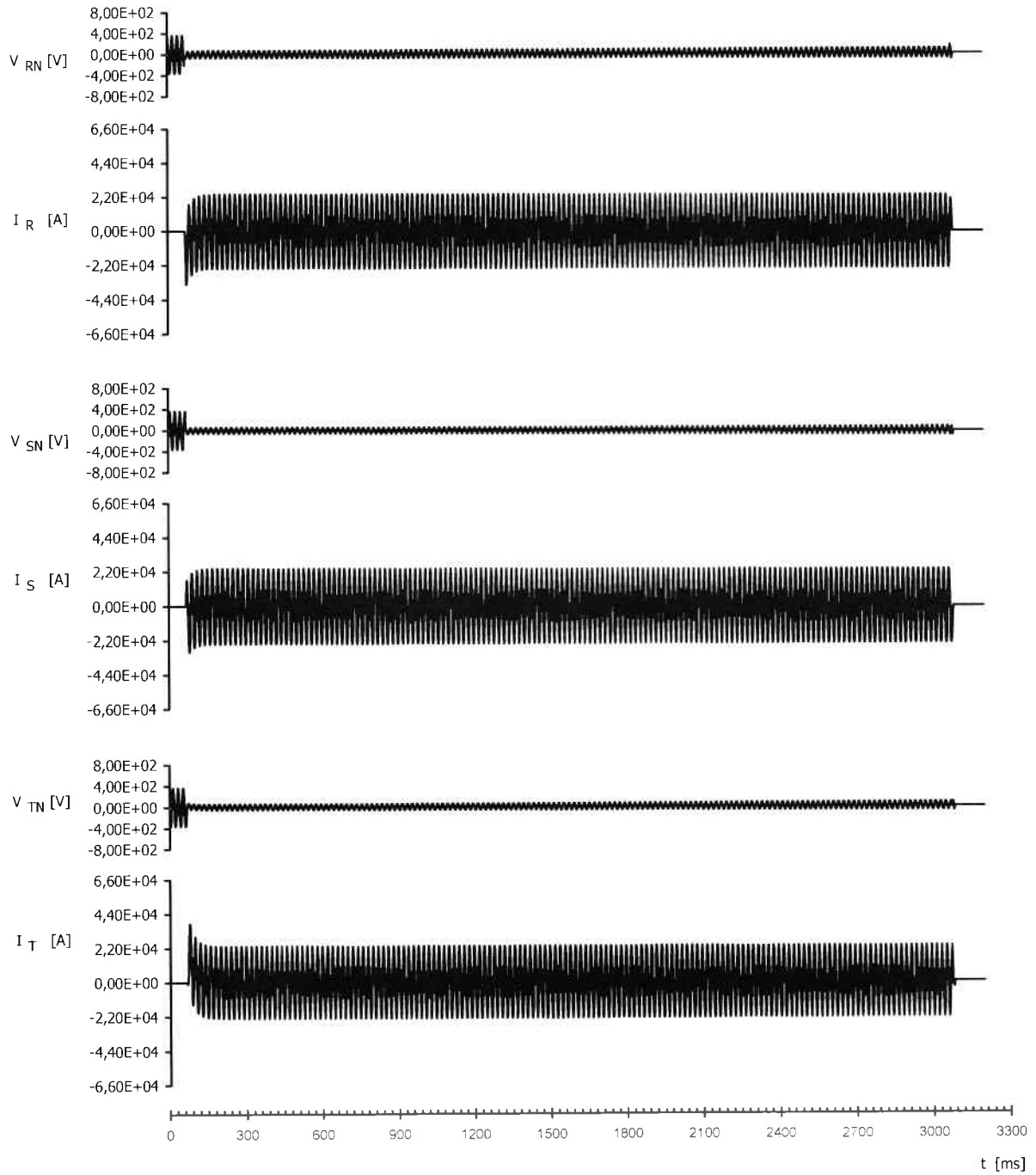
Test No.	Test voltage [V]		Test current [kA]		Duration [s]	I ² t [A] ² .s	Condition after the test current applied	Oscillogram No.
	V _{RT}	V _{ST}	I _{RT}	I _{ST}				
1	V _{RT}	414	I _{RT}	1,00	3,01	3,01	good	09093204
2	V _{RT}	422	I _{RT}	1,02	3,11	3,24	good	09093205
Standard requirement			-	-	-	3.000.000 ¹⁾	No visible damage	-

Note : ¹⁾ Value of Ground fault current for MV ground cable is 1000 A - 3s.

Tested by : *f-*
 Date : 27-12-2009

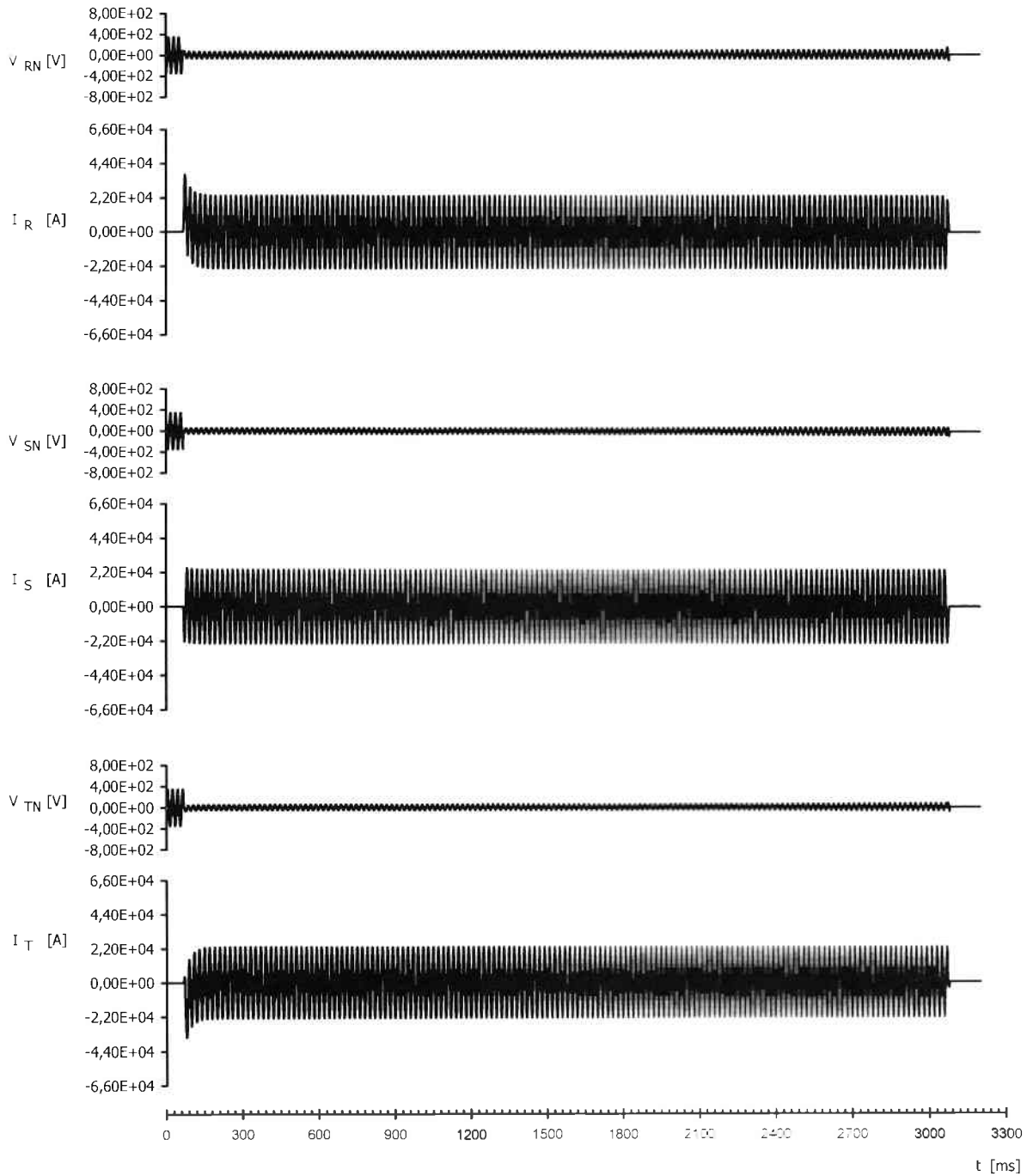
Checked by : *HP*
 Date : 12-07-2010

09093201



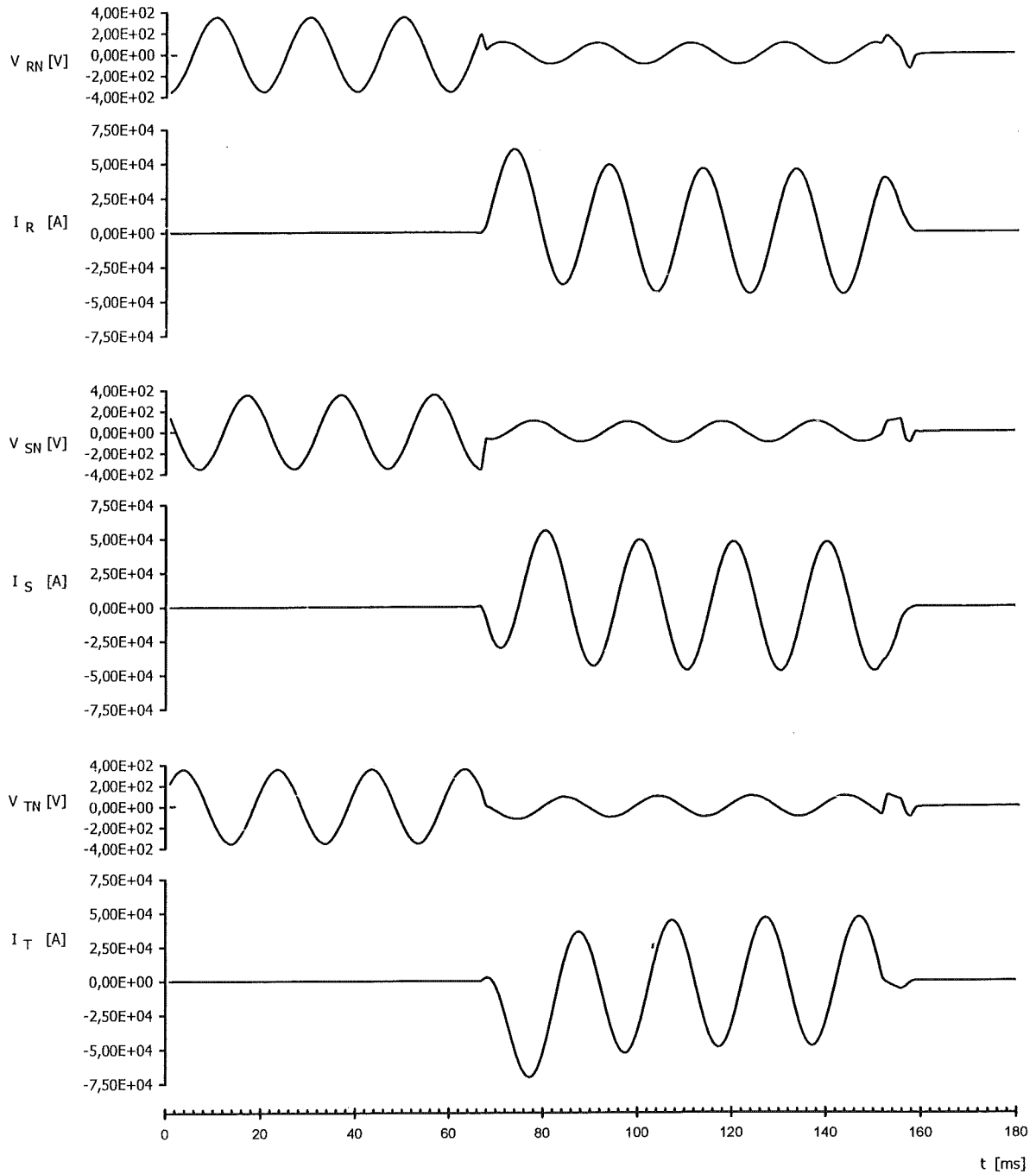
Tegangan suplai [V] Supply voltage		Arus uji [kA] Test current		Durasi [ms] Duration	I ² t [(MA) ² .s]	Faktor daya Power factor
		I _{pk}	I _{rms}			
V _{RN}	257	I _R	-	16,72	3015	843,18
V _{SN}	259	I _S	-	16,83	3015	853,91
V _{TN}	258	I _T	37,70	16,37	3015	807,90

09093202



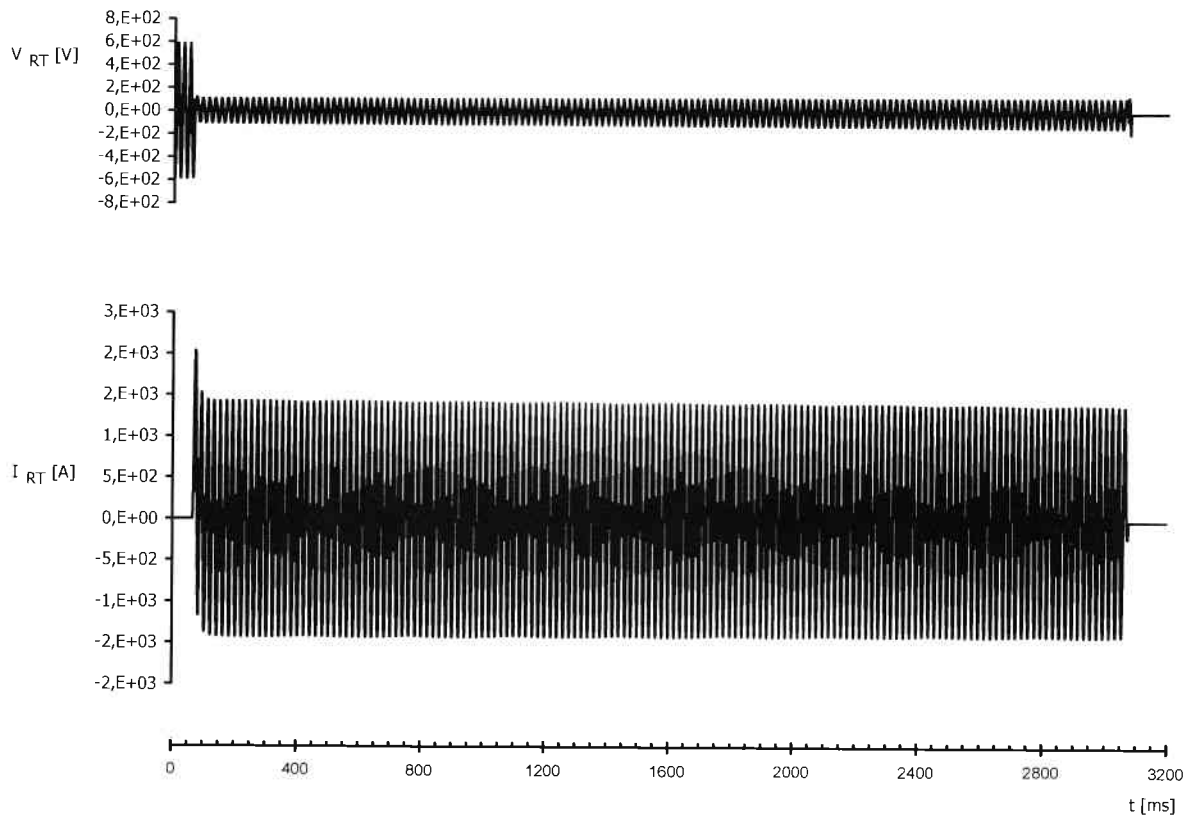
Tegangan suplai [V] <i>Supply voltage</i>		Arus uji [kA] <i>Test current</i>			Durasi [ms] <i>Duration</i>	I ² t [(MA) ² .s]	Faktor daya <i>Power factor</i>
		I _R	I _S	I _T			
V _{RN}	246	I _R	36,90	16,40	3012	810,59	-
V _{SN}	248	I _S	-	16,76	3012	845,91	
V _{TN}	246	I _T	-	16,12	3012	782,88	

09093203



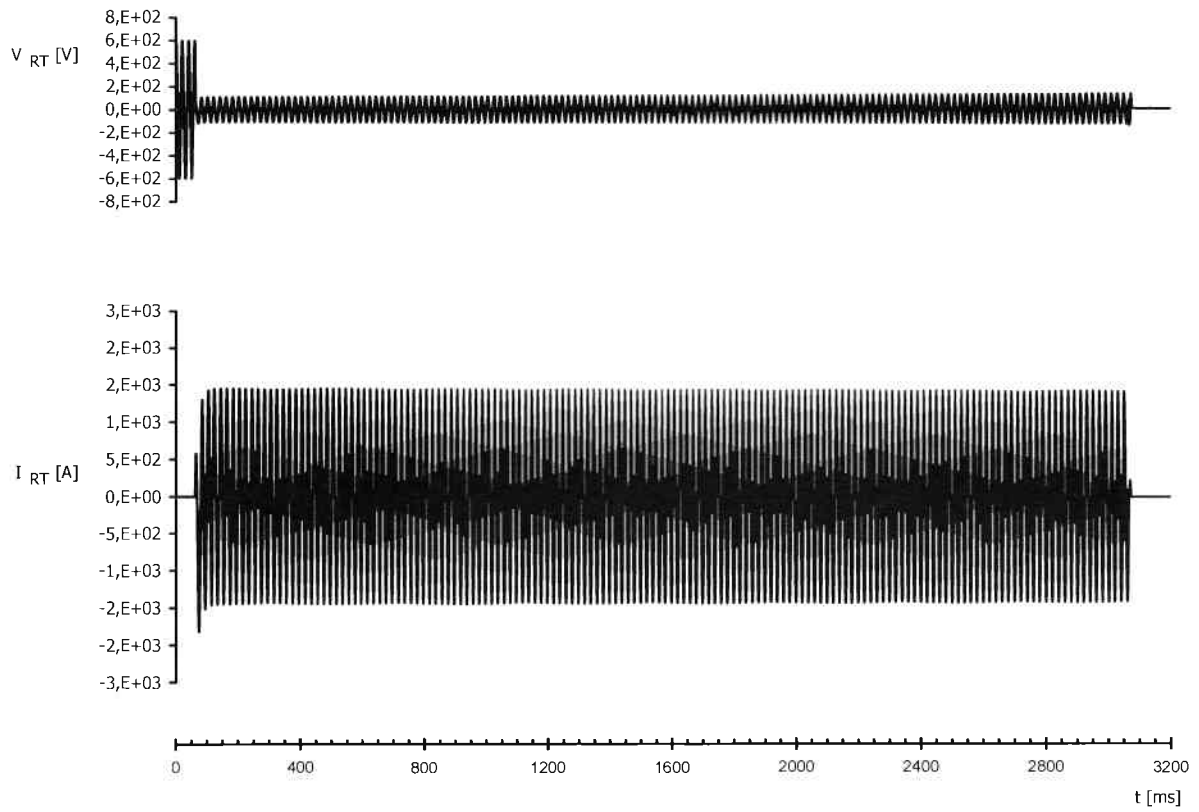
Tegangan suplai [V] Supply voltage		Arus uji [kA] Test current		Durasi [ms] Duration	I ² t [(MA) ² .s]	Faktor daya Power factor
		I _{pk}	I _{rms}			
V _{RN}	249	I _R	- 32,00	90	92,14	-
V _{SN}	251	I _S	- 33,23	90	99,40	
V _{TN}	252	I _T	70,10 33,38	90	100,25	

09093204



Tegangan suplai [V] <i>Supply voltage</i>		Arus uji [kA] <i>Test current</i>		Durasi [s] <i>Duration</i>	I^2t [(A) ² .s]	Faktor daya <i>Power factor</i>	
		I_{pk}	I_{rms}				
V_{RT}	414	I_{RT}	2,04	1,00	3,01	3,02	-

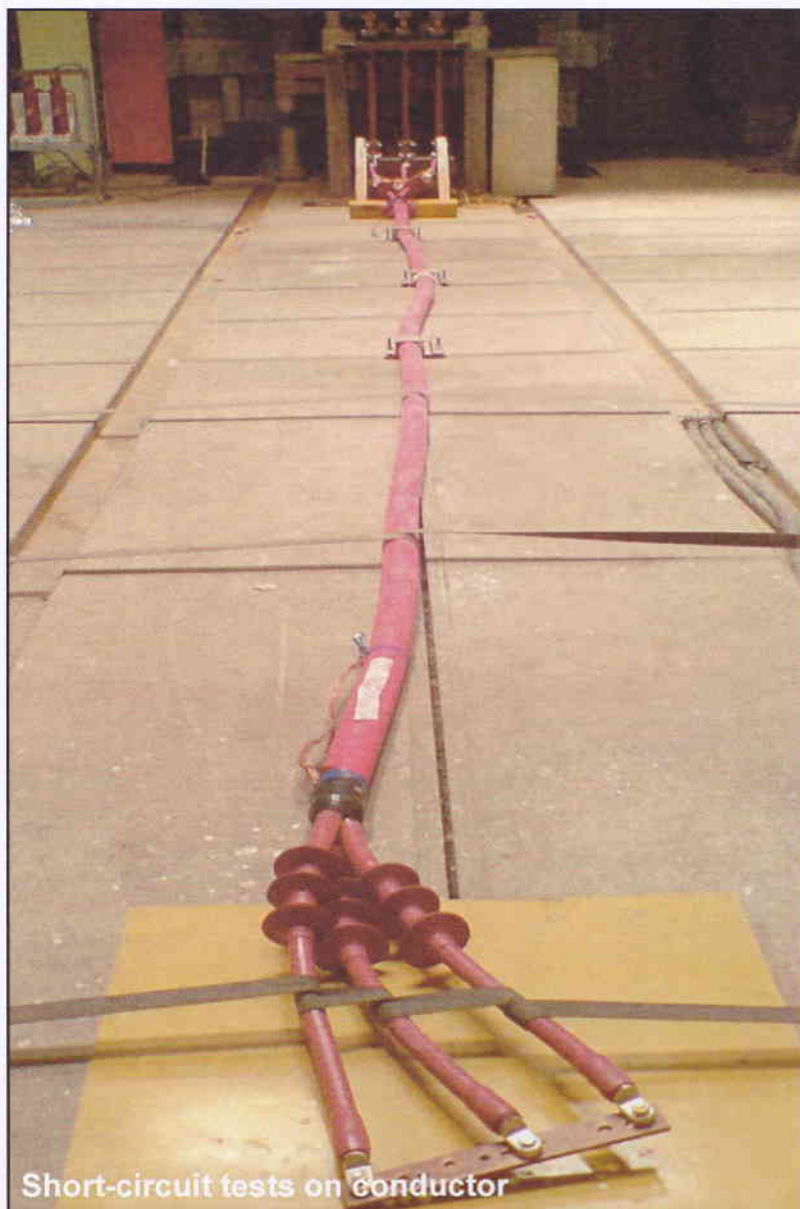
09093205



	Tegangan suplai [V] Supply voltage	Arus uji [kA] Test current		Durasi [s] Duration	I^2t [(A) ² .s]	Faktor daya Power factor
		I_{pk}	I_{rms}			
V_{RT}	422	I_{RT}	1,82	1,02	3,01	3,11

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

TEST PHOTOGRAPH



OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

IMPULSE TEST

Impulse wave shape

Polarity	Wave shape			Oscillogram No.
	front time [μs]	tail time [μs]	over-shoot [%]	
Positive	2,39	53,15	0	IM09-093261, IM09-093262
Negative	2,39	52,65	0	IM09-093263, IM09-093264
Criteria	1 - 5	40 - 60	≤ 5	-

Test results

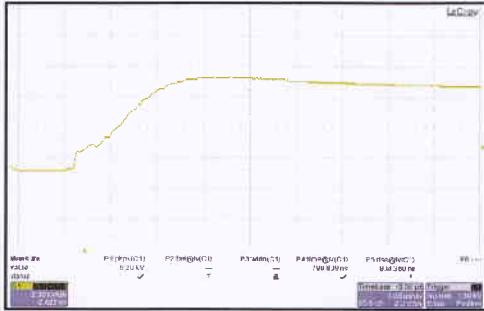
Conductor temperature : 30 °C
 Test voltage : 125 kV 1,2/50 μs
 No. of impulse : 10 impulse of each polarity

Sample No	Core	Polarity	Test result	Oscillogram No.
1.3	1	Positive	Withstood	IM09-0932065 - IM09-0932074
	2		Withstood	
	3		Withstood	
	-		-	
	1	Negative	Withstood	IM09-0932075 - IM09-0932084
	2		Withstood	
	3		Withstood	
	-		-	

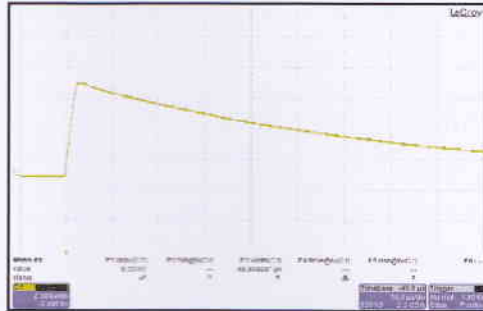
Tested by : *F.*
 Date : 23-12-2009

Checked by : *lbe.*
 Date : 13/07/2010

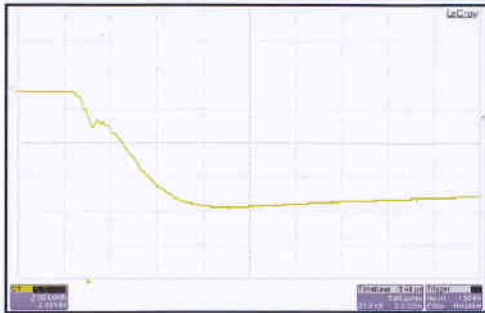
IM09-093261
POSITIVE WAVE - FRONT



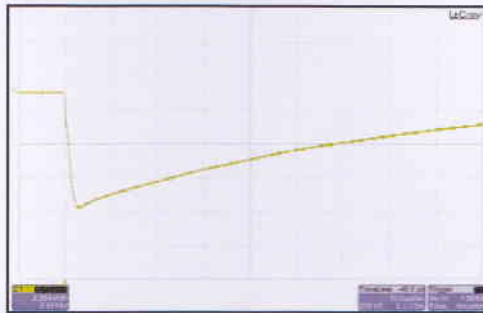
IM09-093262
POSITIVE WAVE - TAIL



IM09-093263
NEGATIVE WAVE - FRONT

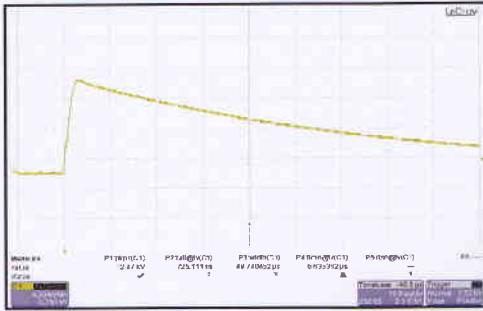


IM09-093264
NEGATIVE WAVE - TAIL

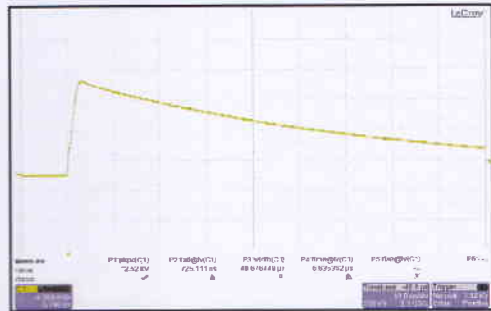


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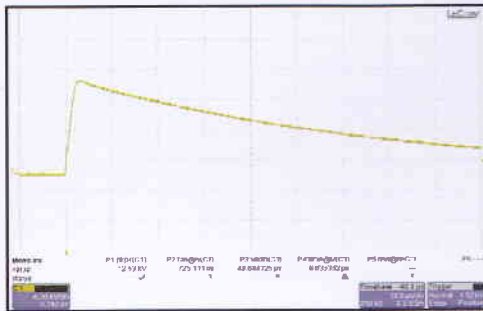
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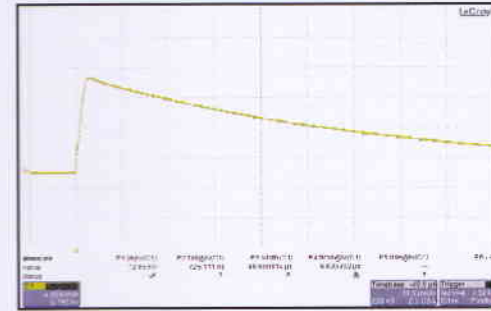
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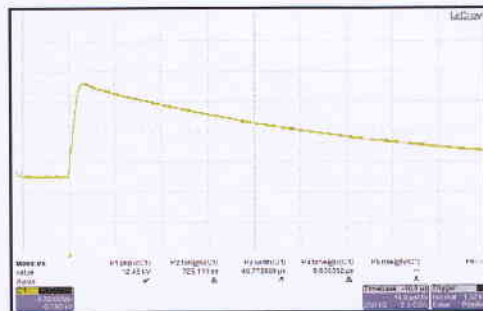
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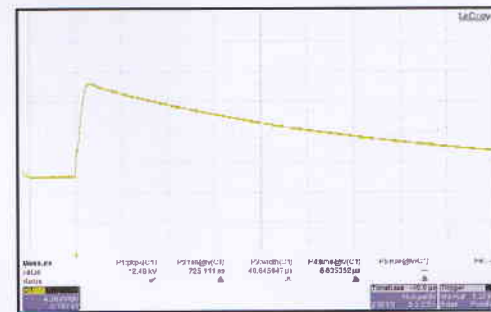
IM09-0932068



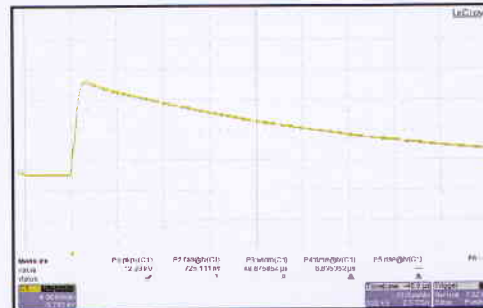
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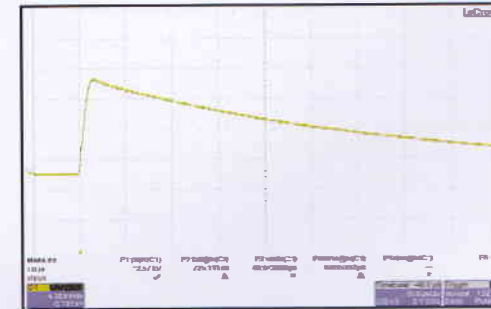
IM09-0932070



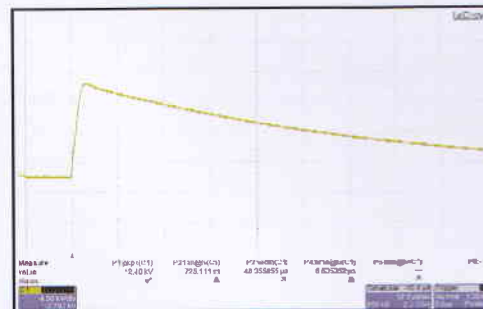
IM09-0932071



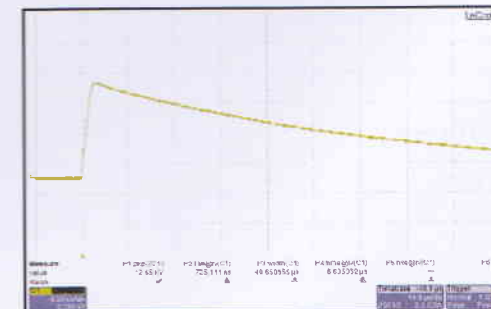
IM09-0932072



IM09-0932073

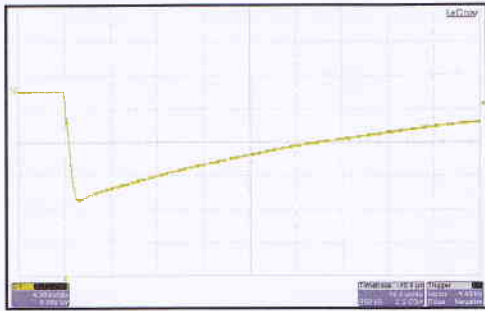


IM09-0932074

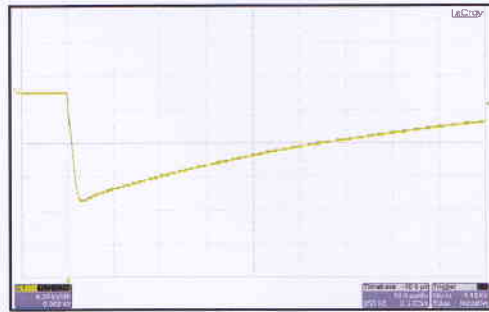


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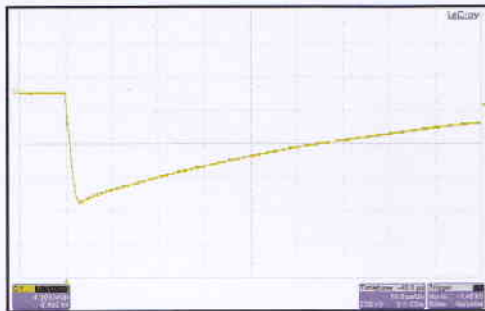
IM09-0932075



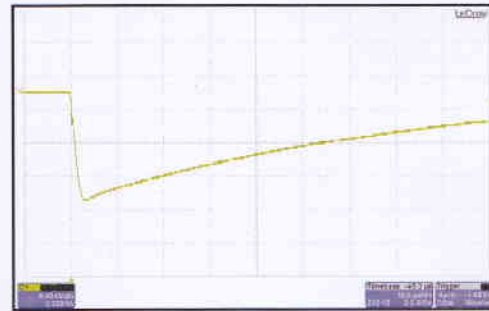
IM09-0932076



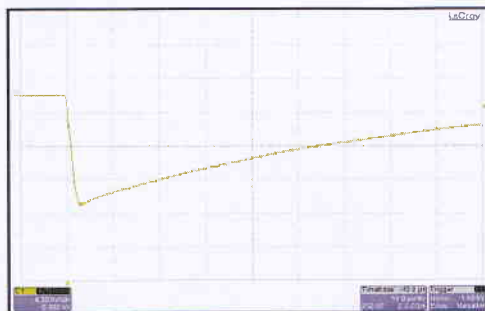
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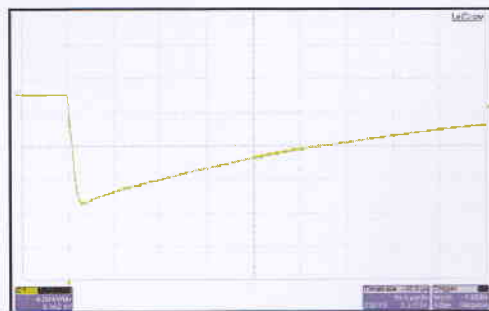
IM09-0932078



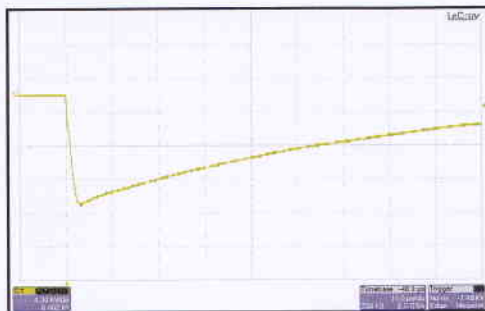
IM09-0932079



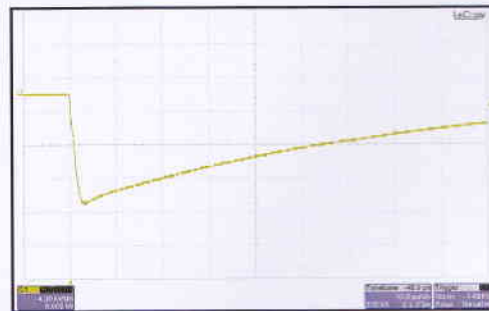
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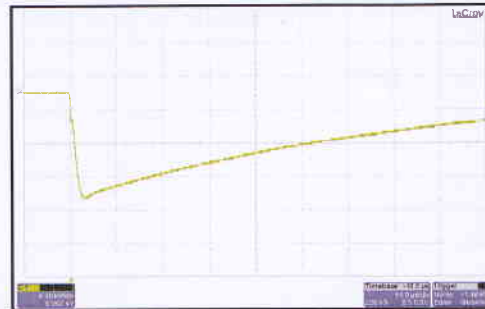
IM09-0932081



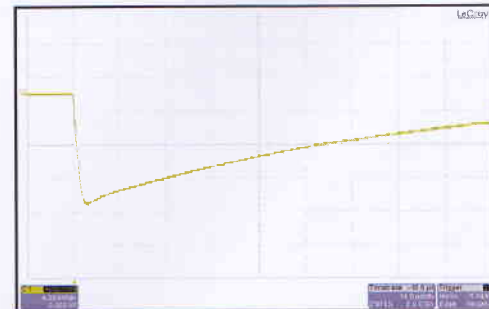
IM09-0932082



IM09-0932083



IM09-0932084



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OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

AC VOLTAGE TEST

Test voltage : 30 kV-AC
 Duration : 15 minutes

Sample №	Core	Test result	Leakage current [mA]
1.3	1	Withstood	25
	2	Withstood	25
	3	Withstood	25
	-	-	-
-	-	-	-
	-	-	-
	-	-	-
	-	-	-

AC VOLTAGE TEST (WET)

Test voltage : -
 Duration : -
 Water conductivity : -

Sample №	Core	Test result	Leakage current [mA]
-	-	-	-
	-	-	-
	-	-	-
	-	-	-
-	-	-	-
	-	-	-
	-	-	-
	-	-	-

Tested by : <i>f.</i> Date : 28-12-2009	Checked by : <i>BC.</i> Date : 13/07/2010
--	--

APPENDIX IV

Test sequence for samples № 1.5

OUTDOOR TERMINATION FOR THREE-CORE XLPE CABLES, 12/20 (24) kV
 TRADEMARK : RAYCHEM, TYPE : EPKT-24C3XOH2-ID01

SALT FOG TEST

Test duration : 1000 hours
 Test voltage : 15 kV
 Water conductivity : (1600 ± 200) mS/m

Sample №	Test result	Standard requirement
1.5	No. of tripping 2x Condition after test, see picture below	No breakdown or flashover No more than three trippings No substantial damage

Note:

It is considered that substantial damage has occurred when it is evident that the performance of the accessory has been severely reduced by:

- (i) loss of dielectric quality due to tracking; and/or
- (ii) erosion to a depth of 2 mm or 50 %, whichever is the smaller, of the wall thickness of the insulating material as applied; and/or
- (iii) splitting of the material; and/or
- (iv) puncture of the material



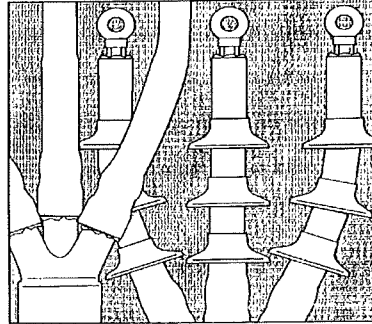
Tested by : *[Signature]*
 Date : 02-12-2009 s/d 11-01-2010

Checked by : *[Signature]*
 Date : 13/07/2010

APPENDIX V
MANUFACTURER'S INSTRUCTION

Energy Division

 **Tyco Electronics**



**Installation Instruction
ESD-5451-ID-4/10**

**Raychem
Termination for Screened
3-Core Polymeric
Insulated Cables
7.2 kV to 36 kV
with Armour**

**EPKT-24C3X0H2-ID01
EPKT-24C3XIH2-ID01**

**Tyco Electronics Raychem GmbH
Energy Division
Finsinger Feld 1
85521 Ottobrunn
0049-89-6089-0 tel
0049-89-6096-345 fax
<http://energy.tycoelectronics.com>**



Raychem

EPKT-24C3XOH2-ID01

QTY 1 PC

OUTDOOR TERMINATION FOR
SCREENED 3-CORE POLYMERIC CABLE
WITH ARMOUR
INCLUDING MECHANICAL LUG
7.2KV TO 36KV: 95-240MM2

TABLE OF KITCONTECT

1	RED INSULATING TUBING	3 PC
2	STRESS CONTROL TUBING	3 PC
3	YELLOW FILLING TAPE	3 PC
4	RED SEALANT TAPE	10 PC
5	MECHANICAL LUG	3 PC
6	SKIRT	9 PC
7	CABLE BREAKOUT	1 PC
8	ROLL SPRING (SMALL)	3 PC
9	ROLL SPRING (BIG)	1 PC
10	EARTH BRAID	3 PC
11	TAPE COPPER ADHESIVE	3 PC
12	INSTALLATION INSTRUCTION	1 PC



Before Starting

- Check to ensure that the kit you are going to use fits the cable.
- Refer to the kit label and the title of the installation instruction.
- Components or working steps may have been improved since you last installed this product.
- Carefully read and follow the steps in the installation instruction.

General Instructions

- Use a propane (preferred) or butane gas torch.
- Ensure the torch is always used in a well-ventilated environment.
- Adjust the torch to obtain a soft blue flame with a yellow tip.
- Pencil-like blue flames should be avoided.
- Keep the torch aimed in the shrink direction to preheat the material.
- Keep the flame moving continuously to avoid scorching the material.
- Clean and degrease all parts that will come into contact with adhesive.
- If a solvent is used follow the manufacturer's handling instructions.
- Tubing should be cut smoothly with a sharp knife leaving no jagged edges.
- Start shrinking the tubing at the position recommended in the instruction.
- Ensure that the tubing is shrunk smoothly all around before continuing along the cable.
- Tubing should be smooth and wrinkle free with inner components clearly defined.

The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, Tyco Electronics has no control over the field conditions which influence product installation. It is the user's responsibility to determine the suitability of the installation method in the user's field conditions.

Tyco Electronics' only obligations are those in Tyco Electronics' standard Conditions of Sale for this product and in no case will Tyco Electronics be liable for any other incidental, indirect or consequential damages arising from the use or misuse of the products.

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Cable Preparation

a. Cable with wire shield

Table 1

Max. system voltage (kV)	*L indoor straight connection [mm]	*L indoor crossed connection [mm]	*L outdoor [mm]	a [mm]	K
7.2	250	450	450	150	according to depth of crimp cable lug barrel hole + 5 mm
12	300	450	650	150	
17.5	350	500	650	150	
24	450	550	800	200	
36	600	800	800	250	

*L = min. length required.

The actual length will be determined by the overall geometry of the equipment.

Remove the release paper and wrap one layer of sealant tape (red) with a small overlap and slight tension around the end of the overshield for 80 mm. Bend the shielding wires back onto the overshield. Avoid crossing individual wires.

Temporarily fix the shielding wires well below the red sealant tape to the overshield.

For cables with tape armour also connect the earth lead to the armour.

For cables with wire armour follow the instruction as supplied in separate armour earthing kit.

Bend and shape the cores into their final position.

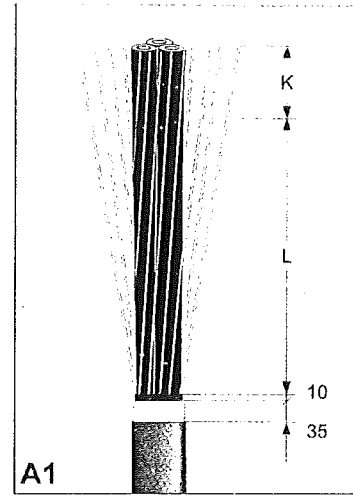
Cut the cores to the required length.

Thoroughly remove the core screen according to dim. a (see Table 1).

The surface of the insulation should be free from all traces of conductive material.

Smooth out any irregularities.

Note: Do not nick the insulation!

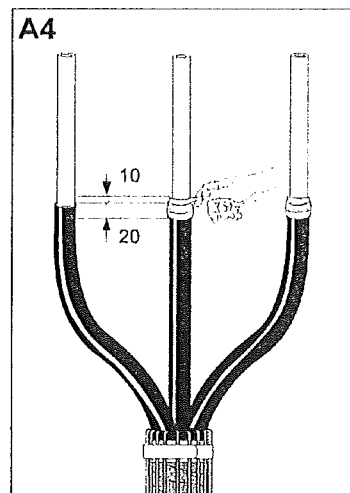
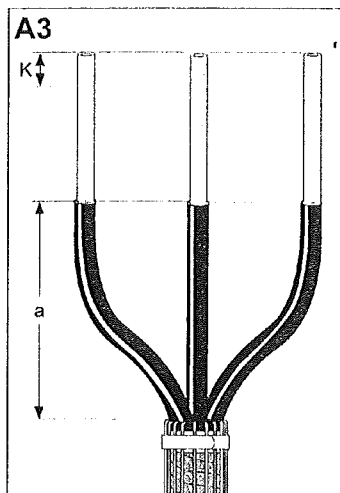
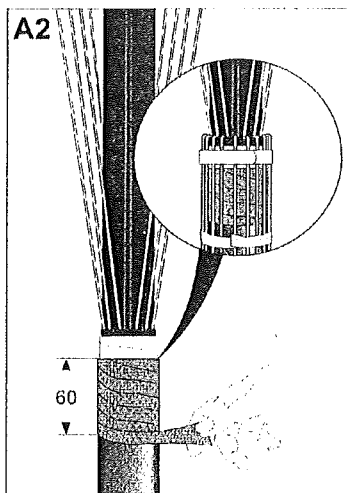


Cut the cable to the required length and remove the overshield.

Leave enough length to set the cores into their final position.

Clean and degrease the end of the overshield for about 100 mm.

Note: The minimum termination length (L) is given in Table 1.



b. Cable with metal tape shield

Table 2

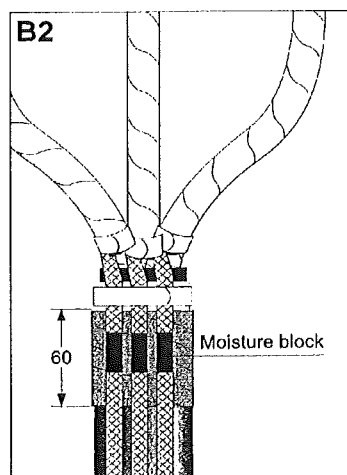
Max. system voltage (kV)	* L indoor straight connection [mm]	* L indoor crossed connection [mm]	* L outdoor [mm]	b [mm]	K
7.2	250	450	450	130	
12	300	450	650	130	according to depth of crimp cable lug barrel hole + 5 mm
17.5	350	500	650	130	
24	450	550	800	180	
36	600	800	800	210	

*L = min. length required.

The actual length will be determined by the overall geometry of the equipment.

Position the end of the earth lead onto the metal tape shield of each core about 100 mm from the end of the overshooth.

Starting at the opposite side of the core, wrap the roll spring twice over the earth lead in direction of the metal tape shield wrap. Fold the earth lead back over the roll spring. Wrap the remaining roll spring around the earth lead. Carefully slide the roll spring and earth lead down into the crutch until it is about 10 mm from the end of the overshooth. Tighten the roll spring with twisting action and fix it into place with two layers of PVC tape. Place the moisture block in the centre of the red sealant tape.



Bend and shape the cores into their final position.

Cut the cores to the required length.

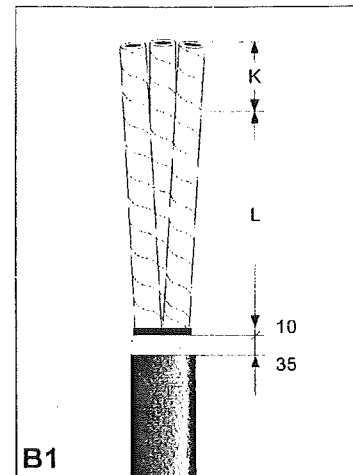
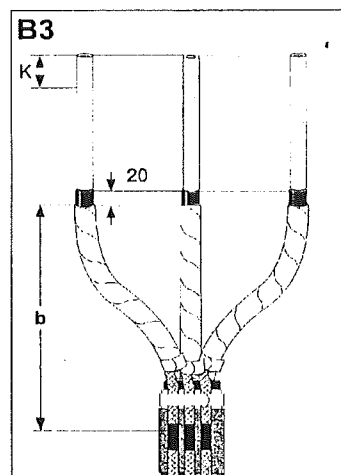
Place a temporary wire binder around the cores at the position shown in the drawing. Tear off the tape shield against the wire binder.

Remove the metal tape shield according to dimension b (see table 2).

Thoroughly remove the core screen to 20 mm above the metal tape shield cut. The surface of the insulation should be free from all traces of conductive material.

Smooth out any irregularities.

Note: Do not nick the insulation.



Cut the cable to the required length and remove the overshooth.

Leave enough length to set the cores into the final position.

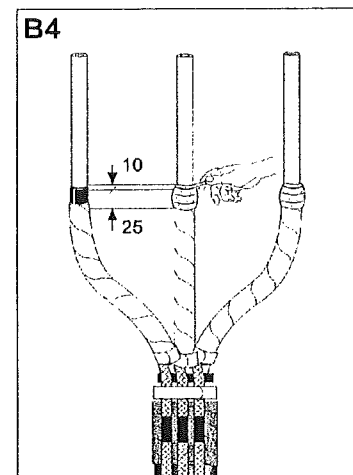
Clean and degrease the end of the overshooth for about 100 mm.

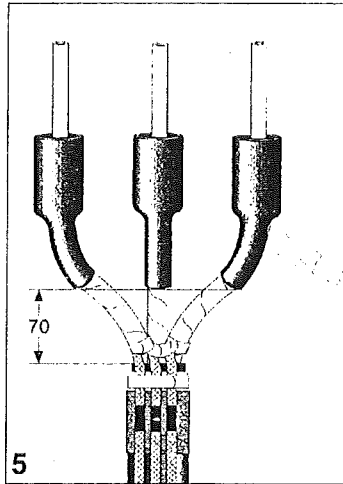
Note: The minimum termination length (L) is given in table 2.

Remove the wire binder from the end of the metal tape shield.

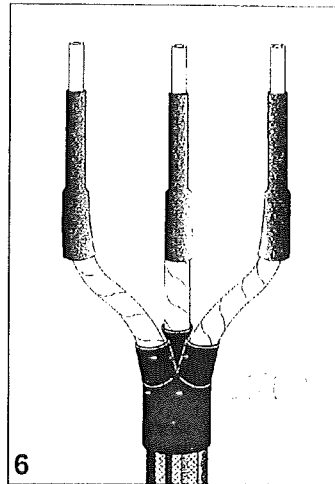
Remove the release paper and wrap the void filling strip (yellow) for 5 mm onto the metal tape shield, continuing over the core screen and 10 mm onto the insulation.

Stretch the strip to half of its original width to achieve a fine, thin edge onto the insulation.

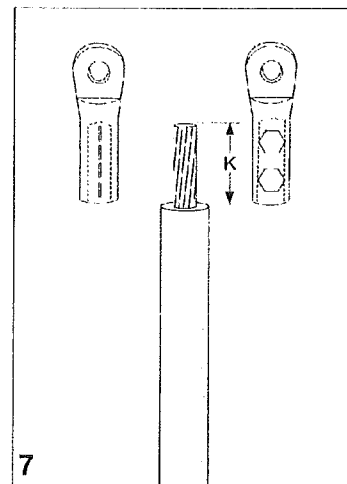




Place the stress control tubing (black) over the cores and position them 70 mm above the end of the oversheath cut.
 Shrink down the tubing starting at the bottom and working upwards..



Remove the release paper and slide the breakout over the cores.
 Pull the breakout as far down the crutch as possible. Shrink the breakout into place starting at the centre.
 Work first towards the lower end and then shrink the turrets onto the cores.
 The numbers in the drawing indicate the shrinking sequence.



Cut back the insulation according to dimension $K = \text{depth of cable lug barrel hole}$

- for mechanical lug + 0 mm
- for crimp lug + 5 mm

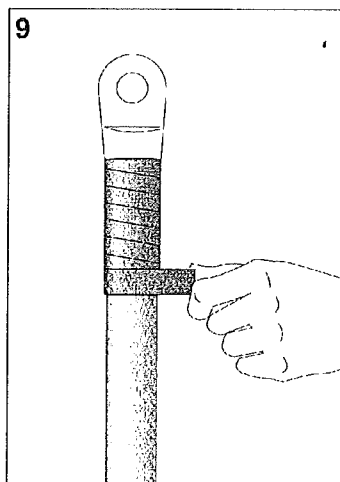
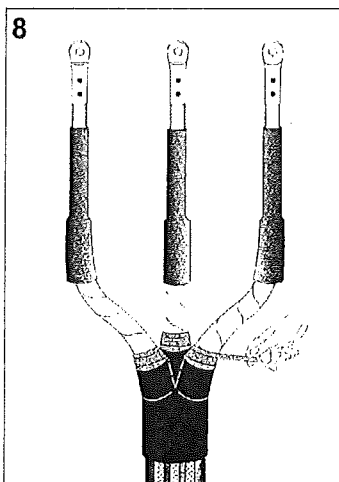
Install the cable lug.
 Clean and degrease the insulation and the lug. Remove any sharp edges.

Place the tubing over the cores with the sealant coated end downwards. Push the tubing over the breakout turrets as far as possible and shrink it down starting at the crutch and working upwards.

Tie the shielding wires or the earth lead with a wire binder to the oversheath below the breakout. Gather the shielding wires together to form an earth lead.

Cut the tubing back onto the connector barrel if necessary.

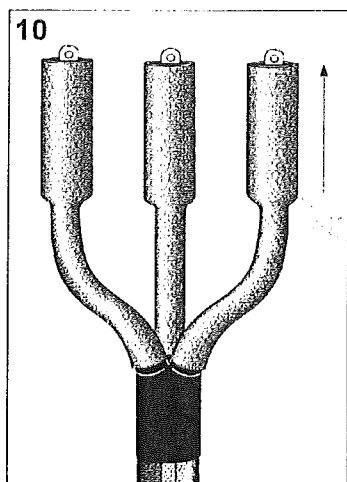
Wrap the sealant tape (red) on the end of the breakout.

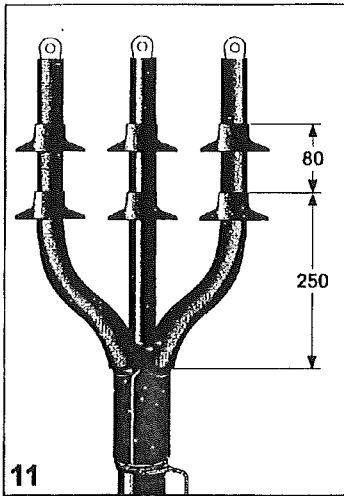


Remove the release paper and wrap the sealant tape (red) around the barrel of the cable lug with a small overlap and slight tension.

Note:

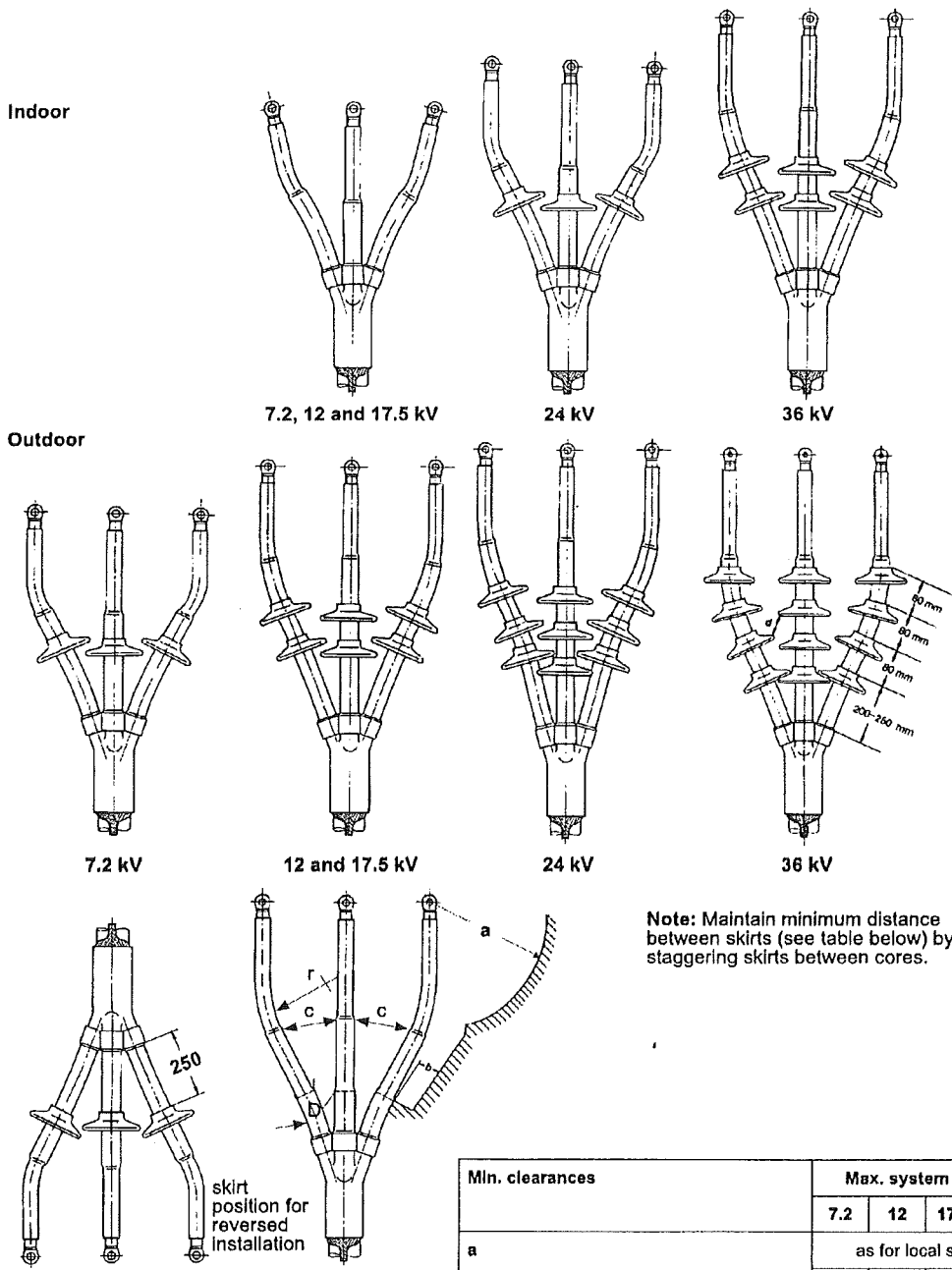
Use the remaining sealant tape (red) to fill any remaining gap between the core insulation and the cable lug.





Shrink the skirts into place as shown on next page.

Allow the termination to cool down before applying any mechanical strain.



Min. clearances	Max. system voltage in kV				
	7.2	12	17.5	24	36
a	as for local specifications				
b Between ph/ground [mm]	10	15	20	25	35
c Between ph/ph [mm]	15	20	30	40	50
d Between skirts [mm]	10	10	15	20	25
r (min. bending radius) = 15 x D, before bending heat cable up to approx. 70°					

Please dispose of all waste according to environmental regulations. 